

RUBEN DE BLIEK

Empirical Studies on the Economic Impact of Trust



Empirical studies on the economic impact of trust

EMPIRICAL STUDIES ON THE ECONOMIC IMPACT OF TRUST

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Preface

My journey that has resulted in this thesis started in 2009. At the time, I was enrolled in the 'Entrepreneurship and Strategy Economics' master's program at the Erasmus University Rotterdam. One of the courses from the curriculum that drew my attention was 'Labour market and Organisation' by Prof.dr. Veenman. In retrospect, enrolling for this course has been one of the best decisions of my life so far.

I remember the friendly atmosphere in the class room and the highly interactive nature of the course. Because the discussed material would often leave me with more questions than answers (I mean this in a very positive way), I soon found myself discussing all sorts of economic and social issues with Prof.dr. Veenman during the coffee breaks. At some point, he must have gotten enough of my queries as he suggested that it would be better for me to search for some of the answers to these questions myself. In the following months we would sporadically meet up and discuss literature, research and my future. I had told that I was looking for opportunities to stay in academia. However, it wasn't until we ran in to each other on the subway a couple of months later that I found out that something had been brewing. Prof.dr. Veenman told me about a discussion he had with Prof.dr. Franses on "*Bowling Alone*" by Robert Putnam (a book about the decline of social capital in the United States) and "*Trust: the Social Virtues and the Creation of Prosperity*" by Francis Fukuyama, a book on how trust facilitates economic development. Furthermore, Prof.dr. Franses had suggested to maybe start a PhD research on both topics. One can imagine that I was very eager to hear more about this project. We set up a meeting that next Monday, and my PhD research was born. Sometimes, a little luck is all you need.

During these four years, I have learned a lot about being an academic. Justus, I cannot thank you enough for this opportunity. I will not forget your countless tips and pointers, as well as your invaluable anecdotes on (the good) life. Also, thank you for giving me the freedom to pursue my own research interests and ideas. Of course, it wasn't always a joy to receive one of my working papers back with comments written on it using three differently colored pens (red, green, black, depending on the severity of your remark). However, in hindsight these have helped me get my research to a higher level. I wish you all the best, whether you are enjoying the fine Dutch or French weather.

I was fortunate enough that Prof.dr. Franses was equally enthusiastic about the topic. Philip Hans, thank you for facilitating this whole process. I have benefited a lot from your econometric insight and tips on how the academic world functions. Your attention to detail has really improved my work.

During my time at Erasmus University I met a lot of interesting individuals that helped me bolster my career as an academic. In particular, I would like to thank Dr. Martijn Burger for co-authoring Chapter 3, and providing me with the opportunity to teach and assist in various bachelor's and master's courses. I would also like to thank Dr. Koning for giving me the opportunity to lecture some of his courses during his absence.

I also thank the PhD committee for being here today. I am honored to defend my thesis for such a diverse group of academics: the fields of economics, sociology and philosophy are all represented. To me, this is a testament to the appeal of research on trust: its

interdisciplinary nature forces one to think outside of traditional academic boundaries. Furthermore, I would like to extend my sincerest thanks to Prof.dr. Christian Bjørnskov for traveling to Rotterdam to join us today. I could not have written my thesis without the valuable insights from your studies on trust and economics.

The same goes for all my (former) office mates, PhD colleagues, and friends, with whom I had so many fun interactions and conversations: Pengfei (dinner at a Chinese restaurant is objectively better when you are around), Michiel (for our philosophical conversations on research and teaching, and of course for the lovely bottle of Westvleteren 12), Cem (especially for the lectures on the Ottoman empire), Kyle (the house parties, Marvin's Thursday afternoon workouts, our trips to Barcelona, London, and last but not least thanks for being here today), Tommi (you still owe me a couple of house movings), Viorel (wish you all the best, wherever you may end up), Justinas (I will keep you posted about my wristwatch endeavors), Jonathan (thank you for opening my ears to classical music, and please: don't ever change), and everybody else at the university. To my paranimf Guido: I have known you since the first week we started studying Economics in Rotterdam. Therefore, it only seems natural to me to also have you standing by my side on this day. You are a true friend. To Cathelijne: thank you for helping me escape from my little academic bubble from time to time. Keep up the good work.

Finally, I would like to thank my family for their unwavering support. Moeder, Arianne, ik ben trots op waar we samen gekomen zijn.

Ruben de Blik
Rotterdam, May 2015

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Gessler: "Very well, you shall prove your skill now. Shoot an apple from the boy's head.
If you miss, your own head shall pay the forfeit."

Walter: "Shoot, Father! Don't be afraid. I promise to stand still."

William: (reluctantly prepares his crossbow)

[...]

Walter: "Here's the apple, Father! I knew you'd never hit me!"

Friedrich Schiller, *William Tell* (1804)

1

Introduction

At the end of my first year as a PhD, I had a bit of a dental accident. While eating a green olive, one of my favorite snacks *if* properly processed, I came across a specimen that still had the pit inside it. Or so I found out: after I had bitten on the olive, a small fragment of one of my teeth chipped. Because the result was a fairly sharp tooth, I decided to have it fixed by a dentist. Unfortunately, I was lacking a dental insurance at the time. However, after asking around for suggestions from some of my friends I found a dentist who would fix my problem and who would accept cash. An appointment was made.

About a week later I was sitting in the dentist's chair. The operation went smoothly, the tooth was polished like a diamond and I got a complete dental check-up as well. I could have spent the €150 that I was quoted in much worse ways. However, upon arriving at the cash register to complete our transaction the dentist discovered a small problem. The credit-card (pin) terminal would not power on. After trying a couple of times she finally gave up and asked me: "Would it be at all possible for you to pay the bill in cash?". In general, I do not carry this amount of money around. Therefore, I replied: "Sure, that's possible, but I would have to go to an ATM first to make a withdrawal." To reassure her of my good intentions, I added: "If you want to, I can leave my driver's license or passport?"

At this point in the story, I should note that the only piece of information available to the dentist on yours truly was a phone number. This is relevant, because it puts the following in perspective. The dentist gazed at me for 1 or 2 seconds, and then she replied: "Well, you seem like a person I can trust so that will not be necessary." Then, she walked to the back of the room to get her purse, and presented me with the key to her bike. "Here, you can use my bike if you want. It is the green one parked right in front of my office. There is an ATM machine about 1 kilometer away from here." She gave me directions to a

nearby bank, and off I went. Ten minutes later I was back at her office and I completed the transaction.¹

I have used this story on numerous occasions, both inside and outside of academia, to illustrate why I think trust matters. However, in particular when presenting for an (international) audience of economists it is met with skepticism. Personally, I do not think that this is because colleagues dismiss the plausibility of the event. Rather, they feel that this type of behavior is anomalous and implausible *in general*. I too agree that my story is quite spectacular. However, from the moment I started studying economics (2003) I have felt that human interaction cannot be fully understood by the standard economic assumptions on behavior and decision making. As a matter of fact, such assumed behavior may not even lead to the best possible outcome. Claiming that trust is relevant for explaining economic outcomes beyond my anecdotal evidence, however, requires doing an extensive research into the matter. That is exactly what I have tried to achieve with this PhD thesis.

Trust

In order to say something meaningful about the event, we need to define some of the elements of the interaction. First, the interaction can be viewed as a 'one-shot' game. This is important, as most economists do agree that trust can develop in settings with repeated interaction (although at this point most would link cooperative 'outcomes' to reputation instead of trust). Second, it is characterized by a particular form of asymmetric information: from the moment that my dentist discovered that her terminal was malfunctioning, an information vacuum on my moral response appeared. The dentist did not know *for a fact* if I had her best interests at heart (i.e. there was the possibility of deceit). What the next logical course of action for this interaction should be crucially depends on the behavioral assumptions one makes.

Let me first introduce the reasoning that is often used to argue *against* trust. A good starting point, in this respect, is the article "*Calculativeness, trust and economic organization*" by Williamson (1993). Two assumptions are used to explain how the interaction will progress. The first is *opportunism*, and goes as follows. In theory, I have very little reason to invest in my reputation vis-à-vis the dentist (unless I deliberately plan on eating more faulty olives). Therefore, given the fact that this is a one-shot meeting, there is the possibility that I behave in a self-interested manner and not pay for the treatment. The second assumption is *bounded rationality*: agents will act rationally given certain reasonable constraints, such as time and cognitive ability. This excludes the possibility of complete contracting, which would involve the time consuming task of bringing in a credible third party (such as a colleague). The solution to this dilemma is provided by a *credible commitment*: given that my dentist knows that there is a probability that I will not tell the whole truth about my intentions of paying my temporary debt to her, she may opt for a safeguard that compels me to complete the transaction (under the assumption that the safeguard is more costly to replace than the economic value of the exchange). In short, Williamson calls this process

¹Proof available from author: I have kept the receipt.

'calculativeness'.

Being a trained economist, this is exactly what I offered to do. However, my dentist politely refused to take my passport as credible commitment to the exchange and instead opted to rely on trust. Again, let's formalize this option. What is trust? A generally used definition of trust is by Barbalet, who states that it is "*the acceptance of dependency in the absence of information about the other's reliability, in order to create an outcome otherwise unavailable*" (Barbalet, 2009, p. 367). Compared to Williamson's operationalization, the element of bounded rationality reappears ('absence of information'). However, it lacks the element of opportunism: people that trust do not expect to be taken advantage of. This is reflected in the following definition which recurs in some of the chapters of this thesis: trust is "*the belief that others will not deliberately or knowingly do us harm, if they can avoid it, and will look after our interests, if this is possible*" (Delhey and Newton, 2005, p. 311).² Therefore, the credible commitment is replaced by trust.

Which types of trust do we know? Generally, three types are recognized in the literature (Newton and Zmerli, 2011). The first, particularized trust, is trust that builds in compact, dense networks of people one personally knows, such as family or friends. The second, interpersonal trust, is trust that builds through loose relations with non-kin individuals (i.e. strangers). The third, institutional trust, is the trust people have in the political system, government and major companies. I acknowledge that elements of all these types of trust could have acted as a substitute for the credible commitment. For instance, my dentist could be close friends with an avid marathon runner working at a neighboring running shoe store, who is capable (and willing) to start a 'hot pursuit' if a fellow entrepreneur is mugged. Alternatively, the dentist practice could be relatively close to a police department. However, I believe that the second type, interpersonal trust, was the most important. Why else would she have trusted a stranger with the keys to her bike as well?

Given that the four studies contained in this thesis are all of an empirical nature, we can be even more precise about interpersonal trust. This requires first to explain how trust is measured. Virtually all empirical studies (including this thesis) use the response to the following survey question: "*Generally speaking, would you say that most people can be trusted, or that you cannot be too careful when dealing with strangers?*", which then is scored on various scales.³ In a recent article on what type of behavior this question *exactly* corresponds to, Sapienza et al. (2013) relate outcomes of a laboratory experiment called the 'trust game' to the outcome of the survey statement. The trust game was designed by Berg et al. (1995) as an extension to the popular 'dictator game', and goes as follows. Two players are located in separate locations (rooms). Player A receives an initial endowment, say €10, which he is asked to split in any amount desired and which is then sent to player B (who remains anonymous to player A). This amount is usually doubled or tripled according to the rules of the game (i.e. if player A sends €5 then player B would in fact receive €10 or

²My dentist probably did not expect me to steal her bike and not pay my bill, as some audience members at conferences jokingly viewed as 'optimal strategy'.

³The most popular is 'yes/no', used by the World Values Survey. Recently, other scales have been used such as 1-10 Likert scales in the European Social Survey or 1-4 in the German Socio-Economic Panel. Higher scores indicate that individuals are more trusting towards strangers.

€15). Player B then decides how much of this money to send back to player A, and how much to keep for himself. This final step usually does not involve an additional increase by 'the game'. The amount that player A sends is dependent on two components: his belief in the trustworthiness of player B, and his specific preference (i.e. risk aversion, altruism, aversion for inequality). What Sapienza et al. (2013) find is that the answer to the survey statement is positively correlated with the 'belief component'. This provides a relatively narrow definition of interpersonal trust in terms of behavior related to economic outcomes: it measures player A's expectation of the trustworthiness of player B. The survey statement on trust therefore tells us how trusting a certain person (in a certain population, region or country) is willing to be, given his 'estimate' on the average trustworthiness of other members of society (i.e. strangers).

Research questions

We have now zoomed in on the exact behavioral element that allowed my dentist and me to complete the transaction. Given that experimental researchers⁴ typically find that players of the trust game play a 'trust strategy' (i.e. player A sends money to B) instead of the game's Nash equilibrium (which predicts that player A sends no money), the outcome of our interaction seems perfectly reasonable. However, recall that one of the main objectives of this thesis is to show that this behavior also holds for macro oriented economic measures. This requires relating trust to various economic outcomes, preferably using different aggregation levels. This is the main strategy for this thesis, which starts at the individual (micro) level and moves up to the country level. I note that previous research shows that the survey statement on trust is cross-culturally equivalent, which allows to straightforwardly compare individuals, regions and countries.⁵ The exact meaning derived from the trust game is put in general terms: trust is the expectation that a stranger (in society A, in region B or country C) will act in a trustworthy manner. I note that because of these different aggregation levels slightly different definitions of trust are used across chapters, depending on the specific empirical phenomenon (and operationalization) that is studied.

Of course, real life is not as stylized as the trust game. Therefore, a logical follow-up question is: what does trust 'do' at each of these aggregation levels to become economically significant? This question is of particular interest to the field, because much of the economics literature on trust does not explicitly operationalize this part. Finally, given that the survey statement on trust is not related to individual preferences, one may wonder how trust develops exactly. This question has been asked in virtually every academic field that studies the concept of trust, such as sociology, psychology and economics (see for instance Lewis and Weigert (1985) or Nannestad (2008)). Again, I will focus my attention to providing an 'economically significant' answer to this question.

⁴For a recent review see Johnson and Mislin (2011).

⁵For evidence on the cross-cultural equivalence within countries and regions see Dinesen (2011) and Freitag and Bauer (2013). For cross-country equivalence see Reeskens and Hooghe (2008) and Van der Veld and Saris (2011). For a related study on the cross-cultural equivalence of the experiments that correlate with the 'base' of the trust game, the dictator game, see Henrich et al. (2005).

Outline

This thesis consists of four chapters on the economic impact of trust. All chapters relate an economic outcome, such as productivity or income, to interpersonal trust. Furthermore, each chapter aims to explain the mechanism behind the economic significance of trust. What follows is a synopsis of the contents of each of the chapters.

Chapter 2 (which has also appeared in the *Journal of Applied Social Science Studies*, 2013) takes the individual level as empirical setting and poses the following question: do individuals with a trusting perception towards strangers have higher incomes? The chapter exploits a data driven classification method to measure interpersonal trust. Contrary to previous studies, trust is conceptualized as a personal skill related to social intelligence. It is hypothesized that individuals who are better able to discern helpful individuals from self-interested individuals will be more trusting, and will have a lower probability of being exploited. The latter should be visible through an increase in the individual's economic performance. Using micro-economic data from the German Socio-Economic Panel (2003, 2008) a latent class model is estimated, which results in two distinct trust classes: one for low, and one for high trust individuals. Subsequently, by entering class membership in a two-wave panel analysis the study finds that belonging to the high trust class positively influences an individual's economic performance, as measured by annual individual labor earnings and hourly wages. Furthermore, low-trust individuals from 2003 that move towards the high-trust class in 2008 show a trust-related income increase of 6 to 9% as compared to individuals that remained in the low-trust category. Using the observed response to the survey question "Do you think that most people are helpful, or that they are self-interested?" as instrumental variable, I show that trust related income differences between and within individuals are robust against endogeneity.

Chapter 3 (joint work with Dr. Martijn Burger, Erasmus Universiteit) moves 'one level up', and considers economic differences between regions in Europe. In particular, it poses the question: "Why do we observe such large differences in foreign direct investments between equally competitive regions?" When investing in a foreign country, multinational enterprises face social, political and organizational information asymmetries. These liabilities of foreignness (LOFs) introduce additional costs, threaten profitability and deter foreign direct investments. In this study we investigate if certain regions are better able to mitigate these liabilities, and therefore attract more greenfield investments (which are expansive investments in a manufacturing or production plant, office or other operational facility, in an area where no such facility yet exists). We identify regional trust, defined as the society average for interpersonal trust per region, as potential mediator of the LOF. Using European cross-sectional data from 2003-2011 on the number of cross-border greenfield investments and the regional trust level, we confirm that the level of regional trust positively affects the number of investments that a region receives. The effect of regional trust is sizable (factor 1.65 and above per one unit increase in regional trust). Firms with a higher probability of facing a LOF (operationalized by geographic, institutional and genetic distance between the home and host country) more often locate in regions with a higher trust level. We show that this result is robust against endogeneity by using the distance to the equator

to estimate differences in the regional trust level (under the assumption that historically, climatic differences triggered the need for a more intensive form of cooperation for farmers further away from the equator, resulting in higher trust levels).

Chapters 4 and 5 deal with macro-level differences in economic outcomes. Both chapters are motivated by the same observation: why do such large differences exist in the outcome of empirical research on the macro economic effect of trust? Theoretically, these differences can be traced back to Francis Fukuyama's *'Trust: The Social Virtues and The Creation of Prosperity'* (1996). The author argues that trust drives the development of modern and efficient economies by lowering transaction costs. The empirical statement derived from this, and which is most often used in the literature, is that high trust countries should have higher levels of economic development (such as higher growth rates, employment levels, per capita income) as compared to low trust countries. Recent review studies conclude that this effect is not always present. I use two strategies to shed some light on the reasons behind these differences.

Chapter 4 suggests that the dominant framework used to empirically model the macro economic effect of trust, Barro-type growth regressions, is not adequate. Instead, the study uses the Solow productivity framework to study the effect of trust. Three effects are recognized. The effect of trust on (i) labor (where trust reduces principal-agent problems related to asymmetric information), (ii) capital (where trust facilitates access to the embedded resources in networks of agents,) and (iii) the quality of institutions (which is affected by trust through the absence of bureaucratic rules, corruption or excessive rent-seeking). To empirically test the sign and significance of the economic effect of trust, the study relates the share of high-trust individuals per country to the between-country level and within-country growth of total factor productivity from the Solow model. Cross-sectionally, the study shows that high-trust countries on average have higher levels of productivity. Longitudinally, the results show that an increase in trust is positively related to the growth of productivity in the last two decades (where $t_1 = 1990 - 1999$, and $t_2 = 2000 - 2008$). However, this relationship only explains productivity growth for developed countries (OECD). This finding suggests that the economic effect of trust may be dependent on within-country development characteristics.

Chapter 5 zooms in on one of these within-country characteristics. This study uses insights from the management literature to explain why countries with high levels of interpersonal trust have higher levels of economic development. The concept of absorptive capacity is used to show that the relationship between a country's technological capabilities and trust level is path dependent. Trust allows countries to more efficiently convert human capital (such as formal education) into technological progress (such as patents). At the same time, the positive demand for higher technological capabilities increases the trust level. A cross-country regression analysis is used to confirm these relationships. The income per capita is used as an example to show that, contrary to findings from previous research, the macro-economic effect of trust runs completely through the development of technological capabilities.

Note

As is common nowadays, the chapters in this thesis are structured as independent works. Therefore, some definitions or citations are repeated across chapters. I have done my best to minimize this inconvenience, but I cannot completely exclude it.

"In long experience I find that a man who trusts nobody is apt to be the kind of man nobody trusts."

Harold MacMillan, 1894-1986

2

Does trust pay off?

An empirical analysis of the effect of trust on personal income

*This chapter has previously appeared as
'Does trust pay off?', Journal of Applied Social Science Studies, vol. 133 (2), 2013.*

2.1 Introduction

Trust, or more generally social capital, is regarded to play an elementary role in the creation of a modern, civil and prosperous society (Fukuyama, 1996; Putnam et al., 1994; Putnam, 2000). It improves societal efficiency by allowing for collective and coordinated action taking, as well as for the successful execution of individual collaborations. Not surprisingly, the concept has found great interest among applied researchers, in particular those concerned with the relationship between trust and economic performance (for recent reviews see Nannestad, 2008, and Westlund and Adam, 2010). However, a number of unresolved issues surrounding the economic impact of the concept remain.

First, although the positive effect of trust on economic performance can be consistently shown to exist in an experimental setting, empirical evidence is biased towards macro level studies. Johnson and Mislin (2011) review the literature on 'trust game' experiments, which aim to prove the mediating role of interpersonal trust in financial exchanges between strangers, and find that trust and game performance (pecuniary outcomes) are intricately linked. A natural extension (and verification) of these results would be to see if this effect is also found outside of the laboratory. However, there has been an almost exclusive focus

on relating aggregate trust statistics (regional, national) to economic performance. As of yet only a single article has dealt with the micro-economic impact of differences in individual trust levels (Slemrod and Katuák, 2005). Furthermore, many of the most cited theoretical papers on the development and effect of trust take the individual level as a reference. For instance, Fukuyama claims that: “*..if individuals interact with each other over time, they develop a stake in the reputation for honesty and reliability. [...] a society composed entirely of Kant’s ‘rational devils’ will develop social capital over time, simply as a matter of the devil’s long-term self-interest.*” (2001, p.16). From a scientific and empirical point of view, the literature is missing proof of the intermediate (micro) effect of trust on economic performance that would further corroborate previous experimental and macro-economic findings.

Secondly, and related to the first issue, previous experimental (lab) research has shown that trust develops over time, affecting economic pay-offs of individuals. Cagno and Sciubba (2010) find that through social interaction and reputation, individuals assess the trustworthiness of strangers and adjust their economic behavior accordingly. Reputation, however, is not as readily observed in real life as it is in the lab.¹ However, through day to day social interactions people develop the social skills needed for ‘survival’ in the economic realm. Individuals that are more skilled in understanding relational cues, such as their own and other people’s mental frames and internal states, are better at making an informed judgment about the appropriate level of trustworthiness for a given relationship (Six et al., 2010; Yamagishi, 2011). Such *social intelligence* is increasingly seen as driver for the development of trust (Yamagishi et al., 1999).

Thirdly, there have been few attempts at appropriately measuring trust at the individual level. Previous cross-sectional research has relied on a trust-related statement in the World Values Survey (WVS), which presents individuals with the question: “*Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?*”. The binary response for this statement allows for the calculation of low and high-trust population shares, which subsequently can be entered into various growth equations. Unfortunately, this procedure is not available when using micro-level data. This necessitates a different approach for classifying individuals based on interpersonal trust.

This study addresses these issues. Using two recent waves (2003, 2008) of the Socio-Economic Panel (SOEP), which holds micro-economic data for German individuals, I show that when analyzing two survey statements related to interpersonal trust using a latent class model, two distinct subpopulations can be discerned. The first can be described as a low-trust class, mostly comprised of individuals answering both statements pessimistically. The second can be described as a high-trust class, with a higher probability of including members answering both statements optimistically. Next, by entering each individual’s class membership into various wage equations, I find that individuals with a higher level of

¹Some would argue that technology is increasingly pushing this boundary. For instance, it is relatively common for individuals to visit customer satisfaction websites before buying a product from a certain brand or retailer. Furthermore, many individuals maintain personal websites or social media outlets, such as LinkedIn, which effectively serve as ‘reputation repositories’. However, it is a little unorthodox to believe that trust is solely derived from this.

interpersonal trust also show a higher economic performance, as measured by the annual level of labor earnings and hourly wage. Furthermore, individuals that move from the low-trust class to the high-trust class during the sample period also show a positive increase in both economic variables. Finally, I provide evidence that trust related income differences between and within individuals are robust against endogeneity by showing that differences in trust can be related to differences in a proxy for social intelligence. More specifically, the latter aims to gauge the different perceptions that individuals have of the trustworthiness of other economic agents. Evidently, individuals who hold perceptions that are more in line with the true population of low and high-trust individuals can make better informed judgments about the trustworthiness of others, and subsequently will more often be correct about when to trust strangers.

The remainder of this paper is organized as follows. Section 2.2 will present the theoretical framework. Section 2.3 will deal with the study's empirical strategy, data and the operationalization of the covariates. In section 2.4, the methods, models and estimation results are presented. Finally, research conclusions are presented in section 2.5.

2.2 Theoretical framework

It is generally understood that trust, or *"the belief that others will not deliberately or knowingly do us harm, if they can avoid it, and will look after our interests, if this is possible"* (Delhey and Newton, 2005, p. 311), is one of the most important drivers for collaborations between individuals to succeed. In terms of economic performance trust has the ability to reduce transaction costs, as it can substitute (partially) for the negotiation, monitoring and enforcement of property rights, contracts and law (Ring and van de Ven, 1992; Gulati, 1998; Ben-Ner and Putterman, 2009), as well as increases the speed and quality of information diffusion across networks of individuals (Uzzi, 1996; Cagno and Sciubba, 2010). Secondly, because trust mitigates principal-agent problems, principals in high-trust economies can cut down on expenses and efforts associated with the monitoring of agents, and devote more time and energy to innovative activities with accompanying higher economic pay-offs (Guiso et al., 2004; Akcomak and ter Weel, 2009). Thirdly, trust facilitates problem solving in a collective action setting. It allows more easily for a consensus to be reached, because it is based on common norms and values (Ostrom, 1990; Alesina and La Ferrara, 2005).

The literature generally recognizes three dimensions of trust (Newton and Zmerli, 2011). The first dimension, thick trust, is trust that is build in compact, dense networks of people, such as family or friend networks. The second, interpersonal trust, is defined as trust that emerges through "spontaneous sociability", or trust that builds through loose relations with non-kin individuals (i.e. strangers). The third, institutional trust, is empirically most often regarded as trust in the political system, government and major companies. The central claim for this final dimension is that societies with "...institutions that enforce or encourage trustworthy behavior (police, courts, civil service and welfare institutions), will develop high levels of social and political trust" (Newton and Zmerli, 2011, p. 173).

Previous macro economic research has shown that of these three mechanisms, interper-

sonal trust is key in explaining differences in economic performance. For instance, Knack and Keefer (1997), Zak and Knack (2001) and Dearmon and Grier (2009) show that differences between levels of interpersonal trust also (partially) explain for differences between economic growth between countries. Additionally, Dincer and Uslander (2009) show that the level of interpersonal trust positively correlates with indicators of economic performance, such as the growth of income and the level of employment for U.S. regions. Furthermore, using non-aggregated individual data from the WVS, Slemrod and Katuák (2005) show that trust has a positive economic effect on individual income, but only if the trust level in a country is above the sample's average. Finally, the positive impact of trust on monetary outcomes in experimental research, most notably those adopting the trust game, is well documented (Johnson and Mislin, 2011).

Some reasons for the sparseness in empirical analysis using micro-level data can be put forward. First, the mechanisms through which interpersonal trust affects economic performance are different for macro and micro levels of analysis. Whereas on a macro-level interpersonal trust is often regarded to develop through education (Knack and Zak, 2003) and the rule-of-law (Bergh and Bjørnskov, 2011; Bjørnskov, 2012), these two variables serve different purposes on a micro level. Most importantly, the level of education usually functions as a direct input for estimating differences in economic performance, whereas the rule-of-law is regarded to apply indiscriminately to all agents. Furthermore, some authors have claimed that social differences between individuals are responsible for lower levels of interpersonal trust through feelings of "threat" towards certain out-group members. In this respect, ethnic (Lancee and Dronkers, 2011; Laurence, 2011), religious (Alesina and La Ferrara, 2002; Lancee and Dronkers, 2011), linguistic (Anderson and Paskeviciute, 2006) and income heterogeneity (Bjørnskov, 2008a) have been shown to potentially hamper the creation of trust. However, from a micro perspective it has been shown that individual levels of interpersonal trust are largely dependent upon individual past traumatic experiences, or belonging to a group that is actively being discriminated against (Alesina and La Ferrara, 2000). Furthermore, most of the aforementioned measures are not readily available on an individual level (nor where they ever intended to be).

Social intelligence

What these previously used measures have in common is that they can be viewed as negative consequences of an a priori circumstance. For instance, it has been argued that trust levels are lower for individuals living in low-trust areas, even when these individuals are economically well off and belong to a cultural group that is not discriminated against.² This would imply that the outlook on the trustworthiness of others is beyond one's self-determination, which is not in line with experimental findings (Cagno and Sciubba, 2010).³

However, recently it has been proposed that in terms of explaining performance, interpersonal trust can also be viewed of as an ability. Individuals who are better in understand-

²Putnam (2007, p. 149) refers to this phenomenon as 'hunkering down'.

³Furthermore, it would require a different empirical strategy as the one henceforth proposed, i.e. one that is based on taking into account the multi-level dynamics of trust in streets, neighborhoods, cities, and so forth.

ing relational cues, such as their own and other people's mental frames and internal states, are better at making an informed judgment about the appropriate level of trustworthiness for a relationship (Six et al., 2010; Yamagishi, 2011). This hypothesis is derived from the fact that it is not realistic to assume that all members of a single society are equally willing to collaborate and trust each other. That is, one cannot simply assume that all members will operate within the mutual interests of others. This trust asymmetry can, in an economic sense, allow an individual to exploit the naive (from his perspective) trusting disposition of another. For instance, individuals that expect people to be motivated in a self-interested manner might take advantage of individuals that are overly trusting towards them. As such, defecting on trust becomes a valid strategy to economize upon.

Agents who are aware of this asymmetry will, however, adjust their behavior accordingly. When individuals are able to effectively tell trustworthy individuals apart from non-trustworthy individuals, the social norm of trustworthiness can help make the economy in a particular population thrive (Shinada and Yamagishi, 2007; Ahn and Esarey, 2008). The ability that allows such judgment is referred to as social intelligence (Yamagishi, 2011). Important to note is that this ability is not set in stone: individuals can update their beliefs about the trustworthiness of others by obtaining a better understanding of the (spectrum of) future behavior of others in the population, and their own response to it (McEvily, 2011).

As of yet a microeconomic empirical analysis of the effect of trust on economic performance are sparse. As such, filling this void will be the primary aim of this research. I will follow a relatively standard wage/income equation approach, augmented with the variable on interpersonal trust. Secondly, this research proposes a panel data approach which allows to model the change of trust within individuals. Thirdly, for measuring interpersonal trust previous research has relied on a trust-related statement in the WVS, which presents individuals with the question: "*Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?*", for which a binary response is available. Subsequently, this response is translated into the percentage of people answering the survey question with "*most people can be trusted*" per country, which is then entered into various economic growth equations. This procedure is invalid for micro economic studies. Therefore, I will aim at classifying individuals in low and high-trust categories. Because interpersonal trust is not directly observed I will incorporate a latent variables approach to achieve such a classification.

2.3 Data and empirical strategy

The German Socio-Economic Panel (SOEP) (Wagner et al., 2007) presents panel data for 17,143 German individuals on key socio-economic variables, specifically on trust, and economic performance indicators, such as an individual's wage, for the survey years of 2003 and 2008. A total of 8,321 individuals are surveyed in both waves.

A standard Mincerian⁴ income (wage) equation strategy of the following form is adopted:

$$\log(y_i) = \beta_0 + \beta_1 \text{human capital}_i + \beta_2 \text{experience}(\text{yrs.}^2)_i + \beta_3 \text{Additional Control variables}_i + \beta_4 \text{trust}_i + \varepsilon_i, \quad (2.1)$$

with i , an identifier for each individual, y_i an individual's economic performance, **Additional Control variables** _{i} , a vector of additional control variables relevant to our study (derived from previous empirical studies), and trust_i , a classification of each individual's trusting perception (towards strangers) based on a Latent Class Analysis. Note that this regression equation is estimated separately for the available survey years, 2003 and 2008. The equation is augmented with the subscript t to estimate the longitudinal version of Equation 1, which for the data available results in the following first-difference regression:

$$\Delta \log(y_{it}) = \beta_0 + \Delta \beta_1 \text{human capital}_{it} + \Delta \beta_2 \text{experience}(\text{yrs.}^2)_{it} + \Delta \beta_3 \text{Additional Control variables}_{it} + \Delta \beta_4 \text{trust}_{it} + \varepsilon_{it}. \quad (2.2)$$

Variables are constructed (extracted) as follows. To measure each individuals economic performance y_i , two variables are constructed. First, I adopt each individual's annual labor earnings, which equals the current year's gross labor income before taxes corrected for the consumer price index (base: 2006 €). In the SOEP, annual labor earnings includes "*wages and salary from all employment including training, primary and secondary jobs, and self-employment, plus income from bonuses, over-time, and profit-sharing*" (Grabka, 2012, p. 50). An alternative to total income is suggested by Petersen (1989), who uses hourly wages as indicator for economic performance. Therefore, I divide each individual's labor earnings by the total hours worked to measure the hourly wage.

To measure *human capital* _{i} , I include each individual's total years of education. Furthermore, each respondent's age and squared age are included to allow to control for age related circumstances that influence economic performance such as on the job training (*experience*(*yrs.*²) _{i}).

Additional control variables

To control for a respondent's actual labor market participation the total number of annual hours worked is included.⁵ Through two dummies I explicitly model for working part-time and being unemployed. Additionally, a dummy variable for gender is considered to control for any labor market differences between males and females. Furthermore, as suggested by recent findings from Alesina and Schuendeln (2007) and Fritsch and Mueller (2008), I control for any left-over income effects of the Communist regime, in power in East-Germany until 1989, by adding a region dummy (West, East).

⁴Mincer (1974).

⁵Note: evidently, this variable is included in the *Hourly wage* variable.

	2003				2008			
	Min.	Max.	Mean	Median	Min.	Max.	Mean	Median
<i>Annual labor earnings</i> *	10	603,979	30,809	25,234	22	866,218	28,611	23,157
<i>Hourly wage</i> *	0	529.74	16.32	13.61	0	1545.9	15.44	12.67
<i>Years of education</i>	7	18	12.5	11.5	7	18	12.7	11.5
<i>Age</i>	17	86	41.7	42	18	86	43.7	44
<i>Annual work hours</i>	0	5,950	1,766	2,026	0	5,384	1,760	2,078
<i>Part – time</i>	0	1	($N_1=2,932$)		0	1	($N_1=2,873$)	
<i>Unemployed</i>	0	1	($N_1=1,717$)		0	1	($N_1=1,199$)	
<i>Gender</i> **	0	1	($N_1=6,367$)		0	1	($N_1=5,626$)	
<i>Region</i> ***	0	1	($N_1=3,174$)		0	1	($N_1=2,725$)	
<i>"On the whole, I trust people"</i>	1	4	2.6	3	1	4	2.6	3
<i>"You can't be too careful [...]"</i>	1	4	2.6	3	1	4	2.6	3
<i>N</i>			13,774				11,691	

* In CPI adjusted, 2006 €.

** Zero indicates male, one indicates female.

*** Zero indicates residency in West-Germany, one indicates in East-Germany.

Table 2.1: Descriptive statistics.

Trust

Starting from 2003, the statements "*On the whole, I trust people*" and "*You cannot be too careful when dealing with strangers*" were incorporated into the SOEP survey, each containing answers on a four-point Likert scale ("*I fully disagree*", "*I somewhat disagree*", "*I somewhat agree*", "*I fully agree*"). Although this particular metric is the de facto standard of measuring interpersonal trust, I further note that it has previously been shown to relate to outcomes from trust game experiments (Glaeser et al., 2000; Naef and Schupp, 2009; Sapienza et al., 2013).

Table 2.1 presents an overview of the aforementioned operationalizations, as well as the descriptive statistics accompanying each variable. Furthermore, from the data a correlation matrix was calculated. The result is provided in Appendix 2.A. Apart from the obvious high correlation between the variable pairs *Annual labor earnings* and *Hourly wage*, and *Age* and *Age*², no multicollinearity problems are expected.⁶

⁶For clarity, I note that one individual was removed from the full SOEP database due to a coding error in the original database on the variable of *Annual work hours*. Furthermore, some variables appear to have a low value (for instance, *Annual labor earnings* of 10€). This is either the actually reported value, or an imputation made by the database maintainers. See Frick et al. (2012).

2.4 Methods and results

To model each individual's interpersonal trust disposition a latent class model for both survey years is estimated. Subsequently, I estimate a series of income and wage equations to estimate economic differences between and within individuals pertaining to their latent class (trust) membership. Additionally, an instrument explaining differences in trust categories through social intelligence is entered in the regressions to show that the results are robust against endogeneity.

2.4.1 Latent class analysis

First, a latent class model is estimated to classify respondents as either low or high-trust individuals. The goal of the latent class model is to identify and classify subpopulations in the data, based on an unobserved or latent categorical variable. The advantage of using latent class analysis over other classification methods is that it is well suited to analyze categorical data, it easily allows for model selection, and its results can straightforwardly be used in subsequent analysis, such as a regression analysis. Furthermore, because class selection is based on a latent variable, we need not make specific assumptions about its true nature. This is particularly convenient for measuring interpersonal trust, which can be affected by sources that are outside the scope of our data. The estimation of the latent classes is performed using the R library 'poLCA' (Linzer and Lewis, 2011).

In short, the latent categorical variable is derived from the available observed or manifest variables, and aims to maximize the expectation about how each individual will respond on each manifest variable. The outcomes of a latent class analysis are probabilities that an individual i 'belongs' to a certain unobserved subgroup or latent class, which can be written as the following product:

$$f(Y_i; \pi_r) = \prod_{j=1}^J \prod_{k=1}^{K_j} (\pi_{jrk})^{Y_{ijk}}, \quad (2.3)$$

where J is the number of manifest variables, K_j the possible responses to these variables, r the class membership, π_{jrk} the probability that an observation in class r produces response k on manifest variable j , and $Y_{ijk} = 1$ if individual i gives response k on manifest variable j (and 0 otherwise). The complete latent class model can be estimated by maximizing the following log-likelihood function through the expectation maximization algorithm (EM):

$$\log. L = \sum_{i=1}^N \ln \sum_{r=1}^R pr \prod_{j=1}^J \prod_{k=1}^{K_j} (\pi_{jrk})^{Y_{ijk}}, \quad (2.4)$$

where R is the total number of latent classes (i.e. the number of categories in the latent variable). Model selection is typically performed using the Bayesian Information Criterion (BIC) (Schwarz, 1978), which allows for the selection of the total number of R latent classes

that minimizes the value for the BIC.

A latent class model is estimated for both survey waves separately. Note that the total number of observations is slightly larger than reported in table 2.1. This is related to the fact that people with no reported labor income are excluded from most of the regression analysis, yet these individuals are considered in the latent class model (provided they recorded full information on both trust statements). I find that a two class ($R = 2$) solution both minimizes the value for the BIC, as well as intuitively classifies each individual based on the manifest response style. A summary is presented in table 2.2.

In terms of relative size, both classes remain rather stable in the 5 year sample period. The first class encompasses a little over forty percent of the individuals, whereas more than half is represented by the second. When looking at the probabilities of encountering a certain statement response K_j , Class 2 is largely made up of individuals answering both survey statements in an optimistic manner: there is an approximate chance of 90% that individuals answer either “*I somewhat agree*” or “*I fully agree*”. For Class 1 the reverse holds true: there is over 80% chance that an individual responds in a pessimistic manner. Furthermore, the manifest responses appear to be consistently optimistic or pessimistic across the two statements, with slightly more spread in the probabilities for the second statement.

Finally, each respondent’s most likely class membership r is extracted and saved as a dummy⁷, taking the value of 1 when a probability π_{jrk} above 0.5 in equation 2.3 for $r = 1$ (high-trust class) is recorded, and 0 otherwise (low-trust class).

⁷This dummy corresponds to $trust_i$ from the wage equation.

		2003		2008	
Statement J	Response K_j	Class 1	Class 2	Class 1	Class 2
		Probability π_{jrk}		Probability π_{jrk}	
<i>"On the whole, I trust people"</i>					
	<i>"I fully disagree"</i>	0.12	0	0.1	0
	<i>"I somewhat disagree"</i>	0.68	0.09	0.72	0.05
	<i>"I somewhat agree"</i>	0.18	0.82	0.16	0.85
	<i>"I fully agree"</i>	0.02	0.09	0.01	0.09
<i>"You can't be too careful when dealing with strangers"</i>					
	<i>"I fully disagree"</i>	0.20	0	0.16	0
	<i>"I somewhat disagree"</i>	0.60	0.14	0.59	0.13
	<i>"I somewhat agree"</i>	0.18	0.71	0.22	0.70
	<i>"I fully agree"</i>	0.02	0.15	0.03	0.16
	<i>Class size</i>	0.42	0.58	0.43	0.57
	<i>N</i>	20,819		17,481	
	<i>BIC</i>	85,092		73,458	

Note: round-off differences can amount to $\sum \pi_{jrk} < 1$.

Table 2.2: Latent class analysis for $R = 2$ latent classes.

2.4.2 Income and wage regressions

Two wage equations are considered to estimate the economic effect of belonging or moving to one of the trust classes: OLS cross-sectional regressions (Table 2.3 and 2.4) and a first-difference panel regression (Table 2.5). Both dependent variables *Annual labor earnings* and *Hourly wage* are logarithmically transformed (base e). Therefore, the reported coefficients should be read in terms of semi-elasticities. This allows for an intuitive treatment of the coefficient estimates as approximate percentage changes of an individual's labor earnings due to changes in one of the independent variables, *ceteris paribus*. Due to the logarithmic transformation, individuals reporting annual labor earnings or wages of size zero were excluded from the analysis.⁸

⁸Note: Appendix 2.C provides alternative estimations techniques for both regressions, among which a Tobit regression model which includes zero-earners.

Sample size

As pointed out by Ziliak and McCloskey (2008) estimations using (relatively) large N samples may correctly specify the coefficients of interest but may yield p-values that easily exceed the confidence values used in the literature (i.e. 90, 95 and 99%). The routinely provided p-values from most statistical packages simply test if the coefficient of interest is significantly different from zero (which it usually is if N is large enough). In the current study, both sample periods have over 10,000 observations which is considerable (both in terms of size and p-value 'bias potential'). Some remedies have been proposed. Ziliak and McCloskey (2008, p. 68) argue that economic significance should supersede statistical significance: the economic interpretation of the effect should dominate the interpretation of the coefficient. More technical procedures have also been proposed. For instance, in a recent review by Lin et al. (2013), the authors find that sub-sampling the raw data or error distribution is also common. However, they concur that the practical significance of the estimate should be more important than the statistical significance. In the current study, I propose to use both. Next to OLS estimations using the complete sample, I employ a bootstrapped re-sampling technique for the standard errors. The regression equation is identical to the OLS regressions, however, the standard error is derived from 1000 random samples of size 0.25 of the original sample. This restriction should increase the uncertainty of the estimate by increasing the standard error.⁹

Variable endogeneity and social intelligence

Previous research has often addressed the possible endogenous nature of interpersonal trust. In general, this suspicion arises from the possibility of observing reverse causality between performance and trust. For instance, high performing countries typically invest more in their educational system, thereby fostering the creation of trust in future generations (Knack, 2001; Bjørnskov, 2006). Similarly, micro levels of interpersonal trust may be affected by a person's current economic situation, if for instance individuals self-select into neighborhoods with higher than average levels of social capital and interpersonal trust, thereby endogenously affecting their personal disposition on trust (see for instance Gomez and Santor, 2001, or Marschall and Stolle, 2004). I return to the discussion of social intelligence to remedy this potential problem. Elementary for the relationship between social intelligence and trust is the ability of individuals to distinguish between trustworthy and untrustworthy individuals (Ahn and Esarey, 2008). Without knowing the true motivation of a randomly drawn economic agent from the population, the best assessment each individual can make on third party trustworthiness is to make an educated guess of the true population shares of trustworthy and untrustworthy individuals.¹⁰ In our current (latent class) framework this would entail correctly inferring that about 40% of the population is of a low-trust nature, whereas 60% of the population holds a high-trust

⁹These errors remain, however, robust to heteroskedasticity. See Ando and Hodoshima (2007).

¹⁰Note that the additional assumption made here is that 'economic life' simply is a continuous string of one-shot ('lab') games.

disposition. Knowing this information would lead to a higher economic performance: given that lab experiments show that there is a positive payoff to trust, playing a 'trust strategy' in real life pays off because on average most people indeed belong to the high-trust class in the German sample (Johnson and Mislin, 2011).

Evidently, this information is latent and not available to any individual. This raises the question: "What type of information do individuals base their decision to trust on?". To a large degree, this decision is dependent upon an individual's assessment of the willingness of an unknown party (stranger) to cooperate. Experimental research shows that revealed third-party self-interest may undermine an individual's willingness to cooperate (Bowles, 2008). In these experiments, most individual's are aware that a certain degree of self-interest is warranted for both parties to benefit. However, an excess of self-interest undermines the reciprocal tendencies of individuals, and consequently the development of trust. Indeed, a study by Cagno and Sciubba (2010) shows that in the laboratory, providing this information to players of the 'trust game' results in the development of two distinct networks of individuals: a 'cooperative' network where trust is high (because trust is reciprocated), and a 'self-interested' network where trust is lower. Furthermore, pecuniary outcomes are higher in the 'cooperative' network of players. This suggests that information on the cooperative nature of others affects one's trusting disposition, which then affects the outcome of economic interactions.

The 'data' that reveals the self-interested or cooperative nature of individuals may come from many different sources. For instance, newspaper reports may provide information on which members of society are helpful, and which are not. Alternatively, previous experiences with fellow members of society may form the basis for this judgment. Although we do not observe the exact process by which individuals make this assessment, it is likely that at some point these impressions give each individual an overall idea about the cooperative or self-interested dispositions of other individuals. I operationalize this 'social intelligence' by adopting the following statement from the SOEP: "*Do you think that most people are helpful, or that they are self-interested?*", which allows for a binary response. I hypothesize that people that infer that most individuals are helpful will also have a more positive outlook on the trustworthiness of strangers, simply because these individuals correctly infer that the share of high-trust individuals is larger in the German sample.¹¹

For the instrumental variable (I.V.) estimations the following first-stage regression is performed on $trust_i$ from Equation 1:

$$trust_i = \beta_0 + \beta_1 \text{social intelligence}_i + \eta_i, \quad (2.5)$$

¹¹This arguments assumes that once the helpful or self-interested nature of another individual is revealed, an individual can make a more informed judgment on the appropriate trusting disposition. In the short run, this can potentially lead to a loss due to exploitation (i.e. a 'mismatch' between a high and low-trust individual). However, in the long run this will most likely reveal that 'most people can be trusted'. If the outcomes from trust games from the lab have external validity, this should result in a higher economic performance for high-trust individuals in the sample (annual income, hourly wage).

with

$$social\ intelligence_i = \begin{cases} 0 & \text{if people are self-interested} \\ 1 & \text{if people are helpful} \end{cases}.$$

The equation is again augmented with subscript t for the first-differenced regression, Equation 2.

Because the endogenous variable is binary a first-stage probit estimator is more appropriate than the (continuous) 2SLS estimator. This instrumental variables estimator, which is described in Maddala (1983) and more commonly known as the two-stage probit least squares estimator, is implemented here. It is estimated through the 'CDSIMEQ' routine in Stata (Keshk, 2003). First-stage regressions are available from Appendix 2.B.

Cross-sectional results

Regression results using the cross-sectional data from each survey year separately are posted in Table 2.3 and Table 2.4. The coefficients should be read as sample characteristics. That is, inferences made are with respect to any arbitrary individual from the German sample, and denote differences between individuals. First-stage regressions for the instrumental variables estimations are posted in Appendix 2.B.

	2003			2008		
	OLS (1)	boot (2)	I.V. (3)	OLS (4)	boot (5)	I.V. (6)
Education (yrs.)	0.07*** (0.00)	0.07*** (0.00)	0.07*** (0.00)	0.07*** (0.00)	0.07*** (0.01)	0.07*** (0.00)
Age (yrs.)	0.08*** (0.00)	0.08*** (0.01)	0.08*** (0.00)	0.07*** (0.00)	0.07*** (0.01)	0.07*** (0.00)
Age ² (100 yrs.)	-0.07*** (0.00)	-0.07*** (0.01)	-0.08*** (0.00)	-0.06*** (0.01)	-0.06*** (0.01)	-0.06*** (0.00)
Annual workhours (100 hrs.)	0.06*** (0.00)	0.06*** (0.00)	0.06*** (0.00)	0.06*** (0.00)	0.06*** (0.00)	0.06*** (0.00)
Part-time	-0.51*** (0.02)	-0.51*** (0.04)	-0.50*** (0.02)	-0.47*** (0.02)	-0.47*** (0.04)	-0.47*** (0.02)
Unemployed	-0.81*** (0.03)	-0.81*** (0.06)	-0.81*** (0.02)	-0.62*** (0.03)	-0.62*** (0.07)	-0.62*** (0.03)
Gender (1=female)	-0.21*** (0.01)	-0.21*** (0.03)	-0.21*** (0.01)	-0.19*** (0.02)	-0.19*** (0.03)	-0.19*** (0.01)
Region (1=East)	-0.37*** (0.01)	-0.37*** (0.03)	-0.36*** (0.01)	-0.35*** (0.02)	-0.35*** (0.03)	-0.35*** (0.02)
Trust class: High	0.04*** (0.01)	0.04* (0.03)	0.03*** (0.01)	0.08*** (0.01)	0.08*** (0.03)	0.02* (0.01)
Constant	6.53*** (0.08)	6.53*** (0.15)	6.55*** (0.07)	6.37*** (0.09)	6.37*** (0.18)	6.40*** (0.08)
Observations	13,774	13,774	13,774	11,691	11,691	11,691
R ²	0.64	0.64	0.64	0.62	0.62	0.62
Adjusted R ²	0.64	0.64		0.62	0.62	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.3: OLS, Bootstrap and IV. model for dependent variable: *Annual labor earnings (log., 2006 Euro)*. Heteroskedasticity robust ('boot': bootstrapped) standard errors in parentheses.

	2003			2008		
	OLS (1)	boot (2)	I.V. (3)	OLS (4)	boot (5)	I.V. (6)
Education (yrs.)	0.08*** (0.00)	0.08*** (0.00)	0.07*** (0.00)	0.08*** (0.00)	0.08*** (0.00)	0.08*** (0.00)
Age (yrs.)	0.06*** (0.00)	0.06*** (0.01)	0.06*** (0.00)	0.06*** (0.00)	0.06*** (0.01)	0.06*** (0.00)
Age ² (100 yrs.)	-0.06*** (0.00)	-0.06*** (0.01)	-0.06*** (0.00)	-0.05*** (0.00)	-0.05*** (0.01)	-0.05*** (0.00)
Part-time	-0.26*** (0.02)	-0.26*** (0.03)	-0.26*** (0.01)	-0.28*** (0.02)	-0.28*** (0.04)	-0.27*** (0.02)
Unemployed	-0.55*** (0.03)	-0.55*** (0.06)	-0.55*** (0.02)	-0.36*** (0.03)	-0.36*** (0.06)	-0.36*** (0.02)
Gender (1=female)	-0.21*** (0.01)	-0.21*** (0.02)	-0.21*** (0.01)	-0.19*** (0.01)	-0.19*** (0.03)	-0.19*** (0.01)
Region (1=East)	-0.40*** (0.01)	-0.40*** (0.03)	-0.39*** (0.01)	-0.38*** (0.01)	-0.38*** (0.03)	-0.38*** (0.01)
Trust class: High	0.04*** (0.01)	0.04* (0.02)	0.03*** (0.01)	0.09*** (0.01)	0.09*** (0.02)	0.01 (0.01)
Constant	0.40*** (0.08)	0.40** (0.16)	0.43*** (0.07)	0.35*** (0.09)	0.35** (0.17)	0.38*** (0.07)
Observations	13,000	13,000	13,000	11,014	11,014	11,014
R ²	0.31	0.31	0.31	0.29	0.29	0.28
Adjusted R ²	0.31	0.31		0.29	0.29	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4: OLS, Bootstrap and I.V. model for dependent variable: *Hourly wage (log., 2006 Euro)*. Heteroskedasticity robust ('boot': bootstrapped) standard errors in parentheses.

The results indicate that over 60% of the variance of annual labor earnings between individuals, and 30% of the variance between hourly wages is explained for. Across all models the coefficient estimates bear the expected signs and magnitudes. Differences in education, work hours, and employment status explain for differences in earnings. Furthermore, the earnings differential attributable to gender is about 20%. In line with previous research the results show that the economic conditions in the East are not as favorable as in the West, as indicated by the negative coefficient for the variable *Region*. Presumably, this is due to the fact that the economy of Eastern Germany is still not as efficient due to economic remnants of the Communist regime.

The difference in annual labor earnings and hourly wages between low and high-trust individuals amounts to approximately 6%. This effect is sizable, considering the fact that an extra year of education on average increases one's income by 7% (wage: 8%). Furthermore, the finding supports previous experimental research on the positive role of trust for economic outcomes: high-trust individuals on average earn more. Furthermore, it is in line with previous macro studies linking economic growth to interpersonal trust.

The positive effect of trust remains after instrumenting for an individual's outlook on the helpfulness of others (with the exception of *Hourly wage* in 2008). The I.V. estimation is slightly smaller than the OLS coefficient estimate. Although the descriptive statistics on trust in table 2.1 as well as the latent class estimation results in table 2.3 show that there is a higher probability that two randomly drawn individuals in the sample are both high-trust individuals, the exact economic effect of meeting 'mister right' (or wrong) are of course unknown. However, results from trust game experiments provide some insight. For instance, Butler et al. (2012) show that self-interested individuals become more competitive in a trust game when confronted with cheating players. Interestingly, the authors note that the definition of 'cheating' is different for participants with self-interested and collaborative value systems: an 'equal split offer' constitutes cheating for self-interested participants, thereby lowering trust and pecuniary transfers among players. Given that the instrument is not perfect¹², it is therefore possible that 'mismatched' high-trust individuals suffer more.

Additional robustness checks

Appendix 2.C provides alternative estimations for the above models. First, a weighted OLS is performed using the cross-sectional weights as provided by the SOEP (Kroh, 2012). These weights aim to account for the stratification of marginal distributions of the population (such as age, gender, household size). Second, a Tobit model is estimated for an extended sample of each cross-section. The extended samples include zero-earners, and are thus censored on the left of the distribution. The model takes into account the fact that trust may affect the complete population, not just income earners. Finally, occasionally multiple household members are surveyed separately. Although these all may earn incomes (or not), some survey responses may be affected by this "grouping" effect. Therefore, regressions using errors clustered on the household level are conducted. I note that the previously

¹²Only around 30% of the respondents say that most people are helpful, whereas 60% fall in the high-trust class.

discussed results remain similar.

Longitudinal results

Regression results using the first-difference data are posted in Table 2.5. The model only considers individuals that were classified as low-trust individuals in 2003. Hence, the estimates should be read as transition coefficients for this specific group. In particular, the dummy variable *Trust class : High* indicates the change in individual labor earnings due to a change in the latent class classification from low to high-trust. In 2003, 2,352 individuals with reported incomes above zero were in the low-trust class (2,206 if hourly wages are used). Of these individuals, 38% moved towards the high-trust class.¹³ Furthermore, the first-stage probit regression posted in Appendix 2.B should be read in a similar fashion. Finally, I note that due to the smaller sample size the bootstrap procedure was performed on a 50% sub-sample (instead of the aforementioned 25%).

¹³This number may appear large, but one has to consider (i) that there are also people moving back from the high to low-trust class (which 'balances out' some of the 38%), and (ii) that trust class membership is estimated and simplified to render two trust classes.

	Annual lab. earn.			Hourly wage		
	<i>OLS</i> (1)	<i>boot</i> (2)	<i>I.V.</i> (3)	<i>OLS</i> (4)	<i>boot</i> (5)	<i>I.V.</i> (6)
Education (yrs.)	0.13*** (0.04)	0.13** (0.06)	0.13*** (0.03)	0.11*** (0.04)	0.11** (0.06)	0.11*** (0.03)
Age ² (100 yrs.)	-0.05*** (0.02)	-0.05* (0.02)	-0.04*** (0.01)	-0.04*** (0.01)	-0.04** (0.02)	-0.04*** (0.01)
Annual workhours (100 hrs.)	0.04*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)
Part-time	-0.28*** (0.06)	-0.28*** (0.08)	-0.28*** (0.04)	-0.21*** (0.05)	-0.21*** (0.07)	-0.20*** (0.04)
Unemployed	-0.34*** (0.07)	-0.34*** (0.10)	-0.33*** (0.04)	-0.25*** (0.06)	-0.25*** (0.08)	-0.24*** (0.04)
Region (1=East)	-0.05 (0.19)	-0.05 (0.26)	-0.04 (0.13)	-0.01 (0.14)	-0.01 (0.20)	-0.00 (0.11)
Trust class: High	0.07** (0.03)	0.07 (0.04)	0.11** (0.05)	0.05* (0.02)	0.05 (0.03)	0.08* (0.04)
Constant	0.16** (0.08)	0.16 (0.11)	0.21*** (0.07)	0.16** (0.06)	0.16* (0.09)	0.20*** (0.06)
Observations	2,352	2,352	2,352	2,206	2,206	2,206
R^2	0.33	0.33	0.33	0.07	0.07	0.07
Adjusted R^2	0.33	0.33		0.07	0.07	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5: First-difference OLS, Bootstrap and I.V. model for dependent variable: *Annual labor earnings* (log., 2006 Euro), *Hourly wage* (log., 2006 Euro). Heteroskedasticity robust (bootstrapped) standard errors in parentheses.

The R^2 values are acceptable considering the data is expressed in first differences.¹⁴ The effect for trust is similar to the cross-sectional estimation: low-trust individuals from 2003 that moved to the high-trust category in 2008 on average have 9% higher annual earnings than individuals that remained in the low-trust category (average from OLS and IV). Furthermore, their wage is about 9% higher. Analogous to the cross-sectional model, the effect remains after instrumenting for an individual's estimate on the helpfulness of others. In a completely anonymous economy, where agents with an optimistic outlook on the trustworthiness of others will engage in collaborations with a probability of at least 0.5 (but not above the threshold of each high-trust subpopulation from the latent class model), moving from low to high-trust will indeed lead to a higher chance of successfully 'matching' trustworthy agents (Ahn and Esarey, 2008). Note that individual agents have no idea about the complete trust-distribution. Therefore, their decision to trust is based on behavioral expectations of the actions and motivations of other agents (and if these agents are generally helpful, or motivated in a self-interested manner). Individuals that become more aware of the appropriate distribution of agent-motivations in the population will also be able to make a more informed decision about the appropriate trust disposition to hold in relation to others. In the German population the high-trust class is relatively larger. Becoming aware of this fact, for instance, through interacting with other agents, helps individuals to make appropriate decisions on trust and trustworthiness. In turn, this decreases the probability that an individual will end up in an exploitative economic interaction, and increases the probability of a fruitful (economic) interaction.

Additional robustness checks

Similar robustness checks as those performed for the cross-sectional regressions were performed on the first-difference data. Results remained similar. Output is available from Table 2.12 from Appendix 2.C.

2.4.3 Limitations

Some limitations of the current study should be recognized. First, because interpersonal trust is measured by the class membership from a Latent Class Analysis, some information on the exact trusting disposition of individuals is lost. Class membership was used because it allows for a straightforward estimation and interpretation of the coefficients. One could use the predicted probability from the Latent Class Analysis to assess each person's trusting disposition. However, given that this would yield a variable with values between 0 and 1, this would again introduce problems with the 2SLS estimator (whereas the two-stage probit least squares estimator is relatively well known).

Related to this issue is the use of the instrument. In particular, does it really measure 'social intelligence'? Granted, the instrument is a relatively coarse description of how successful an individual was in 'matching up' with helpful (trustworthy) individuals. However,

¹⁴See for instance Ashenfelter and Krueger (1994) who estimate a similar wage equation. The values for the R^2 largely overlap.

I believe that it works correctly: in the course of five years, self-interested individuals will find it difficult to keep matching themselves with helpful individuals, and will most likely end up interacting with individuals from the self-interested group. This may in turn lead them to believe that similar to themselves, people in general cannot be trusted. A similar rationale holds for 'helpful' individuals. In the end, this is the process that the instrument aims to capture.

Furthermore, the theory supporting the empirical application in this study is a very direct translation of the 'trust game' from laboratory experiments. In reality, economic interactions are not exclusively one-shot games. Through continuous interactions and (longstanding) relationships people may prefer to interact with certain individuals, which may influence an individual's economic performance. In this sense, this study is a relatively general application that simply aims to show that the 'trust strategy' often observed in the lab also makes sense in real life (external validity). One must note, however, that this claim can perhaps only be made because of the specific sample used in this study: in Germany, the share of high-trust individuals is simply larger. In populations where the share of low-trust individuals is larger, one might reach the opposite conclusion.

2.5 Conclusion

This paper has addressed three issues in the literature on the relationship between interpersonal trust and economic performance: (i) does the effect of trust on economic performance hold in a micro economic empirical setting, (ii) does the effect hold in a longitudinal setting, and (iii) how does one measure interpersonal trust from individual level survey data.

Starting with (iii), two recent waves (2003, 2008) from the German Socio-Economic Panel are used to estimate a latent class model. I find two distinct trust classes in the sample: one class with predominantly low-trust individuals, and one with high-trust individuals. Subsequently, by entering class membership in various income and wage equations, I find that belonging to the high-trust class positively influences an individual's economic performance. I concur that the economic effect of trust as found in various trust game lab-experiments can also be found in 'real life' (i). Furthermore, I find that low-trust individuals that become more optimistic in terms of trusting strangers significantly increase their annual income and hourly wage (ii).

Additionally, I suggest that differences in trust between (and within) individuals can be instrumented for by differences in social intelligence, as measured by a survey statement measuring an individual's outlook on the helpfulness (or self-interest) of other individuals. When viewed through the lens of social intelligence, the positive economic effect of trust suggests the following. Through assessing the willingness of others to cooperate (i.e. being helpful), individuals become aware of the appropriate distribution of cooperative individuals in the population. This serves as a proxy for the general level of trustworthiness of others: if most people are cooperative, then it is 'safe' to be a high-trust individual. Potentially, this helps individuals to recognize and possibly even avoid exploitative economic interactions that would otherwise harm them.

Finally, the question remains why exactly trust changes in individuals over time. Besides social intelligence, good candidates for empirical analysis are the previously mentioned occurrence of a traumatic event (which may also work in reverse, as in the occurrence of an ecstatic event), or inclusion into a social environment that allows more easily for consensus to be reached (for instance, by participation in voluntary associations). Admittedly, this requires the development of new theories on the development of individual interpersonal trust, as well the gathering of individual longitudinal data, either empirical or experimental. However, I believe such strategies hold promise for an improved understanding of the nature and causal link between interpersonal trust and individual economic performance. More importantly, it would allow us to discover ways that both improve on the civil as well as economic properties of life in modern societies.

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Appendix 2.A Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Annual labor earnings (log.)	1.00										
2. Hourly wage (log.)	0.79	1.00									
3. Education (yrs.)	0.30	0.32	1.00								
4. Age (yrs.)	0.22	0.19	0.10	1.00							
5. Age ² (100 yrs.)	0.16	0.16	0.09	0.99	1.00						
6. Annual workhours (100 hrs.)	0.72	0.21	0.18	0.14	0.08	1.00					
7. Part-time	-0.35	-0.17	-0.04	0.08	0.07	-0.41	1.00				
8. Unemployed	-0.37	-0.22	-0.06	0.03	0.07	-0.36	-0.20	1.00			
9. Gender (1=female)	-0.31	-0.23	-0.01	-0.04	-0.05	-0.31	0.42	0.02	1.00		
10. Region (1=East)	-0.10	-0.21	0.06	-0.03	-0.03	0.04	-0.08	0.04	0.01	1.00	
11. Trust class: High	0.05	0.11	0.16	0.04	0.04	-0.02	0.03	-0.02	0.02	-0.06	1.00

Table 2.6: Correlation matrix (pooled samples).

Appendix 2.B First-stage regressions

Note: of the sample, 32.2% of all individuals in 2003 claimed that most people were helpful, whereas 34.3% of all individuals did in 2008.

Cross-sectional

Answering "Helpful" to the question "*Do you think that most people are helpful, or that they are self-interested?*" significantly increases the probability of belonging to the 'High-trust' latent class.

	2003		2008	
	Annual lab. earn.	Hourly wage	Annual lab. earn.	Hourly wage
Helpful, or self-interested? (1=helpful)	1.01*** (0.03)	1.08*** (0.03)	1.02*** (0.03)	1.07*** (0.03)
Constant	0.29*** (0.01)	-0.02 (0.01)	0.29*** (0.01)	-0.02 (0.01)
Observations	13,774	11,691	13,000	11,014
Pseudo R^2	0.08	0.10	0.08	0.10
AIC	15,282.96	13,970.37	14,427.59	13,201.54
BIC	15,298.03	13,985.10	14,442.53	13,216.15

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.7: Probit model for dependent variable: *Trust class: High*. Standard errors in parentheses.

Longitudinal

Answering "Helpful" to the question "*Do you think that most people are helpful, or that they are self-interested?*" significantly increases the probability of switching to the 'High-trust' latent class (2003 to 2008).

	Annual lab. earn.	Hourly wage
Helpful, or self-interested? (1=helpful)	0.64*** (0.06)	0.63*** (0.06)
Constant	-0.37*** (0.03)	-0.37*** (0.03)
Observations	2,352	2,206
Pseudo R^2	0.04	0.04
AIC	3,006.53	2,823.10
BIC	3,018.06	2,834.50

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.8: Probit model for dependent variable: *Trust class: High*. Standard errors in parentheses.

Appendix 2.C Alternative models

	(1)	(2)	(3)	(4)
Education (yrs.)	0.06*** (0.00)	0.06*** (0.00)	1.30*** (0.06)	0.08*** (0.00)
Age (yrs.)	0.08*** (0.01)	0.06*** (0.01)	0.53*** (0.08)	0.14*** (0.01)
Age ² (100 yrs.)	-0.08*** (0.01)	-0.06*** (0.01)	-0.40*** (0.10)	-0.14*** (0.01)
Annual workhours (100 hrs.)	0.06*** (0.00)	0.06*** (0.00)		
Part-time	-0.51*** (0.03)	-0.50*** (0.03)	-2.76*** (0.39)	-1.15*** (0.04)
Unemployed	-0.79*** (0.04)	-0.62*** (0.05)	-3.95*** (0.91)	-1.33*** (0.06)
Gender (1=female)	-0.19*** (0.02)	-0.17*** (0.02)	-2.84*** (0.41)	-0.25*** (0.03)
Region (1=East)	-0.35*** (0.02)	-0.36*** (0.02)	-5.55*** (0.29)	-0.33*** (0.03)
Trust class: High	0.04** (0.02)	0.07*** (0.02)	0.46 (0.29)	0.04* (0.02)
Constant	6.65*** (0.10)	6.64*** (0.12)	-12.44*** (1.64)	6.10*** (0.15)
Observations	13,589	11,527	12,993	11,527
R ²	0.62	0.61	0.15	0.49
Adjusted R ²	0.62	0.61	0.15	0.49

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.9: Weighted OLS for dependent variable: [1,2] *Annual labor earnings (log., 2006 Euro)*; [3,4] *Wage (log., 2006 Euro)*. Heteroskedasticity robust standard errors in parentheses.

	(1)	(2)
Education (yrs.)	0.10*** (0.01)	0.13*** (0.01)
Age (yrs.)	0.14*** (0.02)	0.22*** (0.02)
Age ² (100 yrs.)	-0.27*** (0.02)	-0.34*** (0.02)
Annual workhours (100 hrs.)	0.30*** (0.01)	0.27*** (0.01)
Part-time	2.41*** (0.10)	2.07*** (0.11)
Unemployed	-7.05*** (0.17)	-7.88*** (0.20)
Gender (1=female)	-0.81*** (0.08)	-0.61*** (0.08)
Region (1=East)	-0.36*** (0.08)	-0.51*** (0.08)
Trust class: High	0.30*** (0.07)	0.14* (0.07)
Constant	2.12*** (0.35)	-0.03 (0.41)
Observations	20,820	18,228
Pseudo R^2	0.26	0.27
AIC	86217.62	72890.98
BIC	86305.00	72976.90

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10: Tobit model for dependent variable: *Annual labor earnings (log., 2006 Euro)*. Heteroskedasticity robust standard errors in parentheses.

	(1)	(2)	(3)	(4)
Education (yrs.)	0.06*** (0.00)	0.06*** (0.00)	0.07*** (0.00)	0.07*** (0.00)
Age (yrs.)	0.08*** (0.01)	0.06*** (0.01)	0.06*** (0.01)	0.05*** (0.01)
Age ² (100 yrs.)	-0.08*** (0.01)	-0.06*** (0.01)	-0.06*** (0.01)	-0.05*** (0.01)
Annual workhours (100 hrs.)	0.06*** (0.00)	0.06*** (0.00)		
Part-time	-0.51*** (0.03)	-0.50*** (0.03)	-0.26*** (0.02)	-0.30*** (0.03)
Unemployed	-0.79*** (0.04)	-0.62*** (0.05)	-0.56*** (0.04)	-0.37*** (0.04)
Gender (1=female)	-0.19*** (0.02)	-0.17*** (0.02)	-0.19*** (0.02)	-0.18*** (0.02)
Region (1=East)	-0.35*** (0.02)	-0.36*** (0.03)	-0.38*** (0.02)	-0.38*** (0.02)
Trust class: High	0.04** (0.02)	0.07*** (0.02)	0.03** (0.02)	0.08*** (0.02)
Constant	6.65*** (0.10)	6.64*** (0.12)	0.50*** (0.11)	0.59*** (0.13)
Observations	13,589	11,527	12,828	10,857
R ²	0.62	0.61	0.27	0.25
Adjusted R ²	0.62	0.61	0.27	0.25

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.11: OLS for dependent variable: [1,2] *Annual labor earnings (log., 2006 Euro)*; [3,4] *Wage (log., 2006 Euro)*. Clustered standard errors (household) in parentheses.

	(1)	(2)	(3)	(4)
Education (yrs.)	0.15** (0.06)	0.13*** (0.05)	0.09 (0.06)	0.11*** (0.04)
Age ² (100 yrs.)	-0.08*** (0.02)	-0.05** (0.02)	-0.07*** (0.02)	-0.04*** (0.01)
Annual workhours (100 hrs.)	0.05*** (0.00)	0.04*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)
Part-time	-0.29*** (0.09)	-0.28*** (0.06)	-0.25*** (0.07)	-0.21*** (0.05)
Unemployed	-0.33*** (0.09)	-0.34*** (0.07)	-0.27*** (0.07)	-0.25*** (0.06)
Region (1=East)	0.15 (0.22)	-0.05 (0.23)	0.08 (0.18)	-0.01 (0.17)
Trust class: High	0.06 (0.04)	0.07** (0.03)	0.06* (0.03)	0.05* (0.02)
Constant	0.31*** (0.10)	0.16** (0.08)	0.27*** (0.08)	0.16** (0.06)
Observations	2,305	2,352	2,162	2,206
R ²	0.37	0.33	0.07	0.07
Adjusted R ²	0.37	0.33	0.07	0.07

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.12: First-difference OLS for dependent variable: [1,2] *Annual labor earnings (log., 2006 Euro)*; [3,4] *Wage (log., 2006 Euro)*. Weighted OLS: [2,4]. Robust standard errors in parentheses: [1,3]. Clustered standard errors (household): [2,4]. Note: the cross-sectional weights for 2003 and 2008 were averaged to perform the Weighted OLS regression.

"I trust a good deal to common fame, as we all must. If a man has good corn, or wood, or boards, or pigs, to sell, or can make better chairs or knives, crucibles or church organs, than anybody else, you will find a broad hard-beaten road to his house, though it be in the woods."

Ralph Waldo Emerson, 1803-1882

3

Regional trust, liabilities of foreignness and the location decision of multinational firms in Europe

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3.1 Introduction

In today's globalizing world in which the mobility of capital is steadily increasing, many local business start-ups have their origins in foreign countries. It is estimated that the current volume of capital flows from global foreign direct investments (FDI) is up to five times larger than the trade volume of goods and services (Navaretti and Venables, 2004; Brakman and Garretsen, 2008). As a result, FDI are increasingly seen as an important driver for growth and economic development (Balasubramanyam et al., 1996; Alfaro et al., 2004; Carkovic and Levine, 2005; Hansen and Rand, 2006; Ozturk, 2007). Policy makers have similarly become aware of the positive economic effects that may arise from FDI, such as increases in employment, regional economic growth, increased tax-incomes and other multiplier effects. As a consequence, governments seeking to bolster economic development are in fierce competition over attracting FDI (Gordon, 1999; Burger et al., 2013).

Due to the fact that Europe operates as an economic, political and judicial union national boundaries have blurred. Research shows that both European and non-European multinational enterprises (MNEs) increasingly view regions with similar characteristics, but in different European countries, as closer substitutes than dissimilar regions in the same country (Basile et al., 2009). Given that Europe remains to attract a large portion of the

global flows of FDI¹, differences in regional competitive advantages have been the topic of many recent academic debates in the light of location choices of MNEs (Kitson et al., 2004). These debates are largely centered around observable differences in competitive advantages between locations, such as measured by differences in natural resources (Lederman and Maloney, 2007), the quality of infrastructure (Roberto, 2004) and the quality and availability of both human capital and firm-specific skills from the local workforce (Andersson and Svensson, 1994; Myles Shaver and Flyer, 2000). Nonetheless, the difference in the number of investments between European regions that are relatively equal in terms of these types of competitive advantages are striking. For instance, between 2003 and 2011 the Southern part of Italy (including the provinces of Abruzzo, Molise, Campania, Puglia, Basilicata, and Calabria) attracted a total number of 43 MNEs.² An equally competitive region, the Southern part of Spain (including the provinces Andalusia, Murcia, Ceuta and Melilla) attracted 244 foreign-owned firms. Yet, both regions score roughly equal (around -0.8) on the regional competitiveness index from Eurostat (Dijkstra et al., 2011). Why do we observe such large differences in FDI between equally competitive regions?

In this study, we relate these differences in FDI to non-observable competitive differences between regions. In particular, when an MNE invests in a location abroad it may find that the local cultural, political or economic environment is different from its home country. For example, information about corruption and bribes is crucial for choosing a suitable investment location, yet is often unavailable (or misrepresented) from official government agencies (Habib and Zurawicki, 2002; Rodriguez et al., 2005). Being confronted with bribes, ex post, may therefore hurt the competitive advantage of MNEs. Furthermore, an MNE that aims to introduce organizational practices or business strategies from its home country may find that these clash with the expected modes of conduct in a host country (Weber et al., 1996). Additionally, foreign firms may have less information about local market opportunities, resulting in lost economic potential (Lu and Beamish, 2001).

These potential 'information asymmetry problems', collectively known as the Liability of Foreignness (LOF) (Hymer, 1976), introduce costs to adapt to the foreign environment which provide the MNE with a competitive disadvantage over local firms. Previous studies³ have suggested two mechanisms to overcome this problem: the first is to merge with a local firm (through mergers, acquisitions, joint ventures), effectively bypassing the problem altogether. However, for some forms of FDI, such as greenfield investments, this strategy is not an option. The second mechanism is exclusively focused on overcoming the LOF ex-post of the investment decision by outperforming local firms (for instance, by importing managerial practices from the home country (Zaheer, 1995)). We take a different approach, and argue that MNEs take this problem into account in their location decision (i.e. ex-ante). In particular, we suggest that MNEs locate more often in regions that have a business climate that minimizes the firm's LOF. We take a region's interpersonal trust level as a proxy for this climate, which consists of the regional average score on the survey question "*Generally*

¹According to the 2014 UNCTAD World Investment Report, around 40%.

²Source: Financial Times fDi Market. See Data section.

³For a recent review, see Denk et al. (2012).

speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?” from the European Social Survey. Although the level of regional trust is not directly observed by MNEs, it can be inferred from regional characteristics that are affected by it. For instance, previous research shows that regional trust correlates positively with the absence of corruption (Freitag and Bühlmann, 2009), the innovativeness of regional business clusters (Akcomak and ter Weel, 2009), the quality of human capital (Knack and Zak, 2003) and the rate and quality of entrepreneurial activities in a region (i.e. the ‘entrepreneurial culture’ of a region, see Westlund and Bolton, 2003).⁴ In the current study regional trust is treated as a catch-all variable which acts as a proxy for the quality of the local institutional framework as well as the quality of the local workforce (i.e. the local ‘business climate’).

We hypothesize that regions with a high trust level are viewed as more attractive by MNEs, because these offer a business climate that will either minimize the costs associated with the LOF, or allow the MNE to better compete with local firms. As a result, such regions will attract more investments. We focus on greenfield investments, which are expansive investments in a manufacturing or production plant, office or other operational facility, in an area where no such facility yet exists. Greenfield investments aim at providing long term growth for an MNE, thereby providing sustained economic growth (Mencinger, 2003; Wang and Wong, 2009) and job security for the regions they are located in (Lall, 1995). Furthermore, the LOF is most salient for this type of FDI as greenfield investments do not straightforwardly benefit from locally available information (as opposed to MNEs engaging in mergers and acquisitions).

Cross-sectional data on regional trust is related to the number of cross-border greenfield investment per NUTS1 region in Europe from the Financial Times fDi Markets database. Similar to the level of regional trust the existence of a LOF for each MNE is latent (i.e. firms generally do not communicate that they face social or political problems in a certain location, at least not in a way that could be exploited systemically and empirically). Therefore, we divide the sample into firms that *most likely* will have a high probability of facing a LOF, and firms that face a low probability. Five separate samples are constructed, each consisting of a sub-sample with firms that probably will face a LOF, and those that probably will not. The following criteria are used to assess if an MNE potentially faces a LOF: (i) the home-host country absolute distance (where a firm is counted as facing a LOF when the distance exceeds 3200km., which is the average home-host country distance in the complete sample), (ii) not being a member of the European Union, (iii) not being a democracy, (iv) not being a contingent country and not sharing an official language and (v) having a genetic distance that is larger than the average cross-country genetic distance in the world (Spolaore and Wacziarg, 2009). Whenever an MNE meets a criterion, it is counted in the LOF sample (if not, it is counted in the non-LOF sample). Finally, for each NUTS1 region the total number of LOF and non-LOF greenfield investments are counted for the years 2003-2011.

⁴ All three sources have received ample attention in the literature on the determinants of FDI. For corruption see Wei (1997) and Rodriguez et al. (2005); for innovation clusters see Crozet et al. (2004), Propriis and Driffield (2006), or Cantwell (2009); for a region’s entrepreneurial culture see Majocchi and Presutti (2009).

Our results indicate that, while taking into account the relevant competitive forces of regions (Burger et al., 2013), regions with higher levels of trust attract significantly more greenfield investments. The results indicate that this finding is at least partly related to the LOF: the effect of regional trust is always larger for the LOF sample of MNEs, and the difference between the estimated coefficients of both samples is statistically significant for three out of five samples. Furthermore, we show that these results are robust to endogeneity (in the form of a potential reverse causal relationship between local employment growth due to the greenfield investment and regional trust) by modeling interpersonal trust as a function of historical migratory patterns that may have affected the propensity of individuals in society to cooperate (measured through the distance to the equator).

This paper contributes to the literature on the location decision of MNEs by taking up the research agenda as set out by Pedersen et al. (2013). The authors argue that social capital, defined as “*networks, norms and trust that enhance co-ordination and co-operation between various people and groups within a country or a firm*” (p. 81), is an overlooked concept that may potentially be a useful explanation for the observed differences in FDI across countries. Using the regional trust level, this study takes a first step in empirically relating the concept of social capital (operationalized as trust) to the factors explaining the location choice of MNEs facing costs associated with foreignness.

Furthermore, although the interest in the concept of trust has increased dramatically in the last 15 years the exact mechanisms through which trust affects economic interactions are still largely unknown. We show that part of this effect is related to the internationalization process. High-trust regions attract significantly more greenfield investments, as these regions help the MNE to overcome a LOF.

The remainder of this paper is organized as follows. Section 3.2 will present the theoretical framework. Section 3.3 will briefly discuss the proposed empirical strategy. Section 3.4 will deal with the variable operationalizations. In section 3.5, we will present the study’s results. Finally, our research conclusions are presented in section 3.6.

3.2 Theoretical framework

In general, firms become MNEs if the costs of arm’s length deals on the international market become larger than the costs of internationalization. Dunning’s OLI paradigm (1998; 2008) identifies three factors that determine this cross-border move. Ownership advantages (O) of products or production processes refer to the competitive advantages of MNEs compared to local companies, such as uniquely competitive production techniques or employee skills. Location advantages (L) refer to location-specific comparative advantages, such as favorable tax-rates or an abundance in natural resources. Finally, internalization advantages (I) describe the preferences of MNEs to develop foreign business activities in fully owned subsidiaries (as opposed to market transactions or partnership arrangements such as licensing or a joint ventures, for instance, to protect a recipe or patent).

In the absence of full or objective information about the cultural, political and economic environment of a certain location, the future competitive advantage from a certain location

is uncertain to an MNE. For instance, while the abundance of natural resources may be assessed quite objectively⁵, information on the untrustworthy or discriminatory nature of government officials may be harder to obtain. Knight and Liesch (2002) refer to these different types of knowledge as observables and nonobservables:

"Observables consist of facts, statistics, and other data that serve to describe buyers, business customs, economic and legal environments, and other such details that management at an internationalising firm would want to understand regarding a potential foreign market. Nonobservables are relational in nature and consist of causal statements and explanatory models that describe procedures, methods, and relationships between observables. Nonobservables explain phenomena in foreign markets, procedures for entering such markets, and so forth. Essentially, observables are facts and nonobservables are associations" (Knight and Liesch, 2002, p. 988).

These 'nonobservables', in particular, have gained the interest of researchers in the field of business internationalization after Stephen Hymer's dissertation (published in 1976), where he introduced the concept of the 'liability of foreignness'. The argument made is that foreign firms face costs of doing business abroad because of incomplete information on the local economic, social and political environment. These costs threaten the firm's profitability as well as its local competitive advantage, as local (incumbent) firms are not faced with these costs.

A number of manifestations of the LOF have been investigated, which can broadly be summarized in two categories (Calhoun, 2002). The first deal with the LOFs from the environment external to the firm. These pertain to information asymmetries in the host-location's institutional environment, and can be described as *"unwritten norms, practices and procedures"* (Calhoun, 2002, p. 303). Typical examples are bribery, corruption and MNE discrimination (Wei, 1997, 2000; Habib and Zurawicki, 2002; Rodriguez et al., 2005). The second category deals with the firm's internal environment. Here, cultural differences between local employees and MNE management can potentially result in a LOF (for instance, when the MNE implements norms and procedures that are challenged by local employees due to cultural differences Meyer and Scott, 1983).

Alternatively, the process of internationalization is increasingly viewed as an effort to gain a position in a foreign business network of suppliers and customers (instead of viewing it as a neoclassical market with many independent agents) (Johanson and Vahlne, 1977, 2009). Instead of engaging exclusively in arm's length transactions, firms build relationships through social exchanges (Kelley and Thibaut, 1978; Ring and van de Ven, 1992), they coordinate routines (Cunningham and Homse, 1986; Sinkovics et al., 2011), and share knowledge (Dunning, 1995; Dixon, 2000; Yamin and Otto, 2004; Wang and Noe, 2010). Not being able to gain such a position due to home-host differences in the economic, social or political environment, therefore, introduces a specific foreignness problem to the MNE: the

⁵A typical example here is the valuation and exploration of oil wells by oil drilling companies.

liability of 'outsidership' (Andersson et al., 2007; Johanson and Vahlne, 2009).⁶

The central question in this literature has been to investigate how MNEs overcome the LOF. Two research strands have developed: overcoming the LOF through (i) the choice of entry mode for MNEs or (ii) ex-post improvements in the competitive advantage of the MNE (for a recent review on both, see Denk et al., 2012). Our data on cross-border greenfield investments show that a substantial number of firms do, however, not follow these explanations.

The first strand describes how MNEs eliminate the LOF altogether by engaging in mergers and acquisitions (M&As) and joint ventures, which allow the MNE to turn 'nonobservables' into 'observables' by acquiring locally available (tacit) knowledge from an incumbent firm (Elango and Sambharya, 2004). As research on M&A activity shows, this has by far been the most popular option for internationalizing firms (Kang and Sakai, 2001). However, the number of greenfield investments in Europe remains large. Between 2003 and 2011 the European countries in our sample attracted a total of 25,808 cross-border greenfield investments, of which 11,826 were firms from outside the European Union.⁷ These MNEs often have legitimate reasons not to choose to merge with local firms, for instance, to protect competitive advantages that are unique to the firm.

The second option for overcoming the LOF, improving the firm's competitive advantage, has been researched intensively in the management literature. Common suggestions are implementing firm-specific managerial practices (for instance, 'headquarter' managerial practices: see Zaheer, 1995, and Nachum, 2003), purchasing local resources (such as know-how, see Barnard, 2010) or acquiring endorsement or certification of (credible) third-parties (Bell et al., 2012). The general consensus in this literature is that these measures work best if the home-host country distance is small (Johanson and Vahlne, 1977; Eden and Miller, 2004). This would suggest that MNEs typically avoid culturally dissimilar locations. However, this is not entirely the case. For instance, our data shows that at least 1,136 firms of the 11,826 non-E.U. firms originated from countries where there is no democratically installed government.

LOF and the location decision

An underdeveloped idea in the literature is to assume that MNEs, in particular those seeking to undertake greenfield investments, take the LOF into account in their *location decision*. The LOF is most salient for these investments, as MNEs that engage in greenfield investments forfeit the option to merge or acquire local firms. Furthermore, because the investment is wholly owned and financed by the MNE the potential risk of incurring large losses due to a LOF is large (Dunning and Lundan, 2008).

⁶In an earlier study, Eriksson et al. (1997) proposed that this 'liability of outsidership' was exclusively related to a lack of business market knowledge from the MNE, which negatively affects a firm's ability to build network relationships. Alternatively, the liability of foreignness results from a lack of knowledge on the institutional environment, which is related to the 'psychic' distance between the home and host country. In this study, we will however treat both as belonging to the same problem.

⁷Source: Financial Times fDi Market. See Data section.

The idea that is pursued in this study is the following: the existence of certain 'unobservable' regional characteristics help the MNE to overcome the LOF. Therefore, if an MNE acknowledges that it potentially faces a LOF it will seek out a location that minimizes the probability that a LOF manifests. Assume that an MNE i will locate in a region j where it maximizes its profit Π :

$$\Pi_{i,j} = (1 - LOF_j) \cdot (R_{i,j} - C_{i,j}),$$

where $R_{i,j}$ is the 'observable' revenue that MNE i is able to obtain in region j , $C_{i,j}$ the total costs and LOF_j the unknown probability that an MNE will face a liability of foreignness in region j . Here, the LOF works as an ex-post tax that potentially harms a firm's profitability. Given that the MNE knows its own competitive advantage (R_i and C_i), the internationalization decision is based on the location's competitive advantage (for instance, the available infrastructure or quality of human capital). As discussed in the Introduction, when we control for 'observable' differences in competitive regional characteristics in Europe (R_j and C_j), a large difference in the number of greenfield investments per region persists. This suggests that a possible explanation for these differences relates to the 'nonobservable' competitive advantage of regions. Therefore, the profit maximization problem reduces to estimating the probability that the LOF will (or will not) occur in region j .

Two problems arise. The first is finding a proxy for LOF_j that can explain the large difference in observed FDI between regions. A number of proxies have previously been suggested, such as the quality of local governance (Alguacil et al., 2011; Charron et al., 2014) or the level corruption (Wei, 1997, 2000). However, these only provide a limited operationalization of the LOF problem. Ideally, both the internal and external dimensions of the LOF should be captured (Calhoun, 2002). The second problem is related to the manifestation of the LOF: if, in theory, the LOF is unobservable ex-ante of the investment decision, how are MNEs able to take this proxy into account in their location decision?

To answer the first question, we propose to take the level of regional trust. This proxy originates from the seminal study "*Making Democracy Work: Civic Traditions in Modern Italy*" by Putnam et al. (1994). The authors relate the large regional differences in the quality of governance in Italy to differences in the structure of the family. Low institutional quality and strong family bonds are exemplary for the South, whereas the relatively open family networks of the North promoted interpersonal interactions outside the confounds of the family. This increased trust, resulting in a higher quality of governance. This specific type of trust, interpersonal trust, can be viewed as "*the acceptance of dependency in the absence of information about the other's reliability, in order to create an outcome otherwise unavailable*" (Barbalet, 2009, p. 367). In "*Trust: The Social Virtue And The Creation of prosperity*", Fukuyama (1996) extends this idea to the development of economies. He argues that trust acts as a 'currency' for economic growth and development, as it allows to substitute for formal agreements (and thus to lower transaction costs).⁸

⁸For recent empirical reviews supporting these theories see Bjørnskov (2006; 2010; 2012) and Westlund and Adam (2010).

Trust has been a popular concept in the international business literature since Madhok (1995) described its role in the internationalization process of MNEs (also see Madhok, 2005, and Svejnova, 2005). However, in this strand of literature the nature of trust is bilateral, and largely the product of the relationships of firms between local firms. In this study, we view trust as a proxy for a 'business climate' that may mitigate the LOF (Pedersen et al., 2013). In particular, we relate regional trust to the regional quality of governance, and the regional quality of the workforce.⁹

This choice is based on previous empirical research which shows that trust can potentially mitigate both dimensions of the LOF. For the *external environment LOF*, cross-country analysis shows that countries with transparent rules and regulations have higher levels of trust (Bjørnskov, 2010). A transparently operating, corruption-free institutional environment may signal a low LOF to firms wanting to invest in a location. Second, trust partially mitigates the negotiation, monitoring and enforcement of property rights and contracts (Ben-Ner and Putterman, 2009; Bjørnskov and Voigt, 2014). Therefore, institutions that impose little bureaucratic burdens on FDI inflow may be preferred by MNEs (for example, see Fredriksson et al., 2003).

For the *internal environment LOF* a similar argument can be made. Because local employment is often preferred over employment by expatriates for greenfield investments, the cultural characteristics of workers in a particular region are relevant factors in an MNE's investment decision (Lall, 1995). In fact, Mezas (2002b) shows that local employment may actually help the MNE to overcome a LOF. Specifically, differences in culture may hinder the implementation of firm-specific management practices that can increase the local competitive advantage of the MNE (Mezas, 2002a). For instance, Tata and Prasad (1998) and Mathews et al. (2001) argue that the success of implementation of quality management practices across national cultures differs greatly. Trust may help to align different cultural perspectives towards the MNEs managerial goals (Six, 2007). Note that the development of trust is not necessarily superior under specific cultural configurations (although the process by which trust is built differs across cultures, see Doney et al., 1998). Neither should this matter to the firm: what matters is if individuals 'can be trusted' with the firm's management practices. Put differently: are the individuals in a certain regions trustworthy? Previous research shows that people that score high on survey statements related to trust are generally also more trustworthy themselves (Rotter, 1980). Therefore, MNEs that locate in regions with a large share of high-trust individuals will potentially face less problems concerning the transfer of managerial practices, and may therefore be preferred.¹⁰

⁹In this sense, the definition of trust used by Delhey and Newton (2005) is also relevant to mention: "*the belief that others will not deliberately or knowingly do us harm, if they can avoid it, and will look after our interests, if this is possible*" (p. 311). From the viewpoint of the MNE, trust as a business climate can be viewed as the belief that local institutions and workforces will not purposefully exploit the LOF, but in fact will help the MNE overcome the problems related to it.

¹⁰This is because the firm operates under a single 'bottom line': profit maximization. Six (2007) describes this as follows: trust building between two actors depends on the normative context of each of the actors; what both feel is 'appropriate behavior' given a certain situation. This normative context is culturally dependent. Understanding or acknowledging this dependency allows for trust to build, if the objective of the firm is uniform (for instance, increasing its local revenue stream) and the policy towards obtaining the objective is framed as a 'joint goal' for

Furthermore, the liability of outsidership is more easily overcome in high-trust regions. Previous research shows that individuals that express high levels of trust are better equipped to exploit network opportunities and develop profitable entrepreneurial activities (Coviello and Munro, 1995; Ardichvili et al., 2003; Westlund and Bolton, 2003). These may provide additional income for the MNE that may help it with overcoming the LOF. Furthermore, MNEs that produce distinctive and inimitable products and services rely on the development of local linkages (i.e. to overcome the liability of outsidership) (Chen et al., 2004). Research shows that high-trust regions are better able to develop these linkages, and facilitate innovation (Laursen et al., 2012). Finally, individuals in high-trust regions seem better able to build intra-firm relationships and share knowledge between firms; knowledge that may help the MNE to overcome the LOF (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998; Zaheer et al., 1998; Inkpen and Tsang, 2005; Fink and Kessler, 2010; Holste and Fields, 2010).

A visual representation of these arguments is provided in Appendix 3.A. Note that for firms not facing a LOF, a positive effect of regional trust still may be found as one can argue that firms *in general* look for these elements in a region's business climate. The aim, however, is to show that the effect is larger for firms facing a LOF. Because the amount of 'nonobservable' information for these firms will generally be larger, these firms face a larger risk of hurting their profits and long-term competitive advantage when they do not overcome a LOF.

The second question deals with how MNEs can observe the proxy for mitigating the LOF, regional trust, and take it into account in their location decision. Two theory-dependent arguments can be put forward: (i) the eclectic paradigm, which states that firms systematically analyze the benefits from internationalization prior to going abroad (Dunning, 1998; 2008); and (ii) the Uppsala model of internationalization, which states that firms make a gradual decision to move abroad by first building local relationships (i.e. prior to the investment decision) (Johanson and Vahlne, 1977, 2009). We note that substantial differences remain between scholars on which of the two theories is most appropriate when investigating the LOF (see for instance Zaheer, 2002, pp. 352-353). Here, we solely use the distinction between both to guide our argument.

Using the eclectic paradigm, Sethi and Guisinger (2002) argue that firms that are better in 'reading' the international business environment (which consists of all factors that may influence R_j and C_j) are better able to adapt to the local environment and cope with LOFs. A number of practical examples can be put forward. First, prior to investing firms may assess the transparency of rules and regulations by collecting information on the ease of obtaining foreign credit, or the ease by which the required permits necessary to construct a new facility are obtained. Often, this information is readily available. For instance, the International Finance Corporation and the World Bank jointly provide reports on the ease of doing business for many countries.¹¹ These include detailed within-country reports on

both actors. The author suggests that these latter policies should be designed to stimulate 'frame resonance', or a frame that promotes cooperation towards achieving the firm's goal (rather than promoting self-interest). In this process, normative contexts of individual actors gradually lose dominance.

¹¹See <http://www.doingbusiness.org/>

measures such as the 'time required to electricity' (i.e. how many days it takes to obtain a permanent electricity connection) or 'the time required to start a business' (i.e. the number of days needed to complete the legal procedures to start operating a new business). Indeed, a recent review by Dunning (2006, p.188) shows that these institutional elements slowly start to find their way in the location choice of MNEs.

Furthermore, prior to hiring local employees MNEs will typically assess their quality, including their interpersonal skills. Chia (2005) documents a case for multinational accounting firms which measure the emotional intelligence of prospective candidate's through formal assessments. The author provides a number of question categories that are included in the emotional intelligence tests, such as "*[...]the ability to] establish and maintain mutually satisfying relationships*" and "*Be conscious of and able to appreciate the feelings of others*". The author shows that emotional intelligence is correlated with the probability that a candidate will receive a job at the MNE.¹²

The Uppsala model of internationalization, which takes the liability of outsidership as its central argument, states that relationship-building and knowledge creation (and sharing) are key to the success of an international venture. Zaheer and Nachum (2011) argue that firms often lack the capability or incentive to systemically search for a suitable location. However, MNEs can turn generic location resources into firm specific competitive advantages by 'engaging' with a location, which consists of "*actions such as developing knowledge of the immediate environment that becomes, to some extent, exclusive to the firm, [...] developing relationships with powerful actors and institutions [...] and associating with the reputation of a location*" (Zaheer and Nachum, 2011, p.100). A similar argument is made by Cantwell (2009). The author stresses the importance of knowledge creation and sharing, and extends this line of thinking to forging alliances with local (host-country) firms and institutions.

Furthermore, knowledge on the regional trust level can arise from prior relationships of the MNE in the host country (i.e. ex-ante of the investment decision). For instance, through buying or selling products and services in a host country prior to establishing a greenfield location, MNEs may gather information on potential LOFs, or have experience with mitigating LOFs (see for instance Zaheer and Mosakowski, 1997). Particularly for MNEs with activities in many countries, prior experience with various institutional, economic and political environments may ease the choice for a certain location (Mezias, 2002a). Similarly, worker mobility may provide information on the interpersonal qualities of a local workforce (Görg and Strobl, 2005).

¹²These example questions, which are devoid of a 'normative context', support the previously mentioned arguments by Doney et al. (1998) and Six (2007), who state that trust can develop despite differences in national cultures.

3.3 Empirical strategy

The aim of this study is to show that trust mitigates the LOF. If this effect of trust holds, then regions with higher trust levels should attract a larger number of MNEs that face a LOF (as opposed MNEs that do not face a LOF). We estimate the following system of equations:

$$\begin{cases} N_j^{LOF} &= \beta_0 + \beta_1 \text{Regional trust}_j + \beta_2 \mathbf{L controls}_j + \varepsilon_j \\ N_j^{\neq LOF} &= \beta_0 + \beta_3 \text{Regional trust}_j + \beta_2 \mathbf{L controls}_j + \varepsilon_j \end{cases}, \quad (3.1)$$

with N_j^{LOF} the number of greenfield investments per region from MNEs that face a LOF, $N_j^{\neq LOF}$ the number of investments per region from MNEs that do not face a LOF, Regional trust_j the average trust level per region, and $\mathbf{L controls}_j$ a vector of variables controlling for a region's competitive advantages. If trust is indeed the mechanism that drives the decision of MNEs, faced with a LOF, to move to a certain location the coefficient from the first equation should be greater than the coefficient from the second, or:

Hypothesis *MNEs that have a high probability of facing a liability of foreignness will more often locate in regions with a high trust level.*

The next step is to distinguish between firms that face a LOF, and firms that do not. This information, however, is often latent. For instance, MNEs do generally not communicate whether they had to pay bribes in order to be able to invest in a certain location. We offer five operationalizations, some of which have previously been used in the LOF literature, to assess if an MNE potentially faces a LOF:

- i. The absolute distance between the home and host country. This operationalization goes back to Johanson and Vahlne (1977), who use the 'psychic distance' between countries, or "*the sum of factors preventing the flow of information from and to the market*" (p.24), to express a LOF. Basically, this operates as a relatively general metric that takes into account all potential differences (social, political, economic), and is therefore most easily operationalized with the geographic distance between the home and host country.
- ii. If the MNE is from within ($N_j^{\neq LOF}$) or outside (N_j^{LOF}) the European Union (E.U.). Miller and Richards (2002) show that for the E.U., foreign-owned financial firms perform worse than domestic financial firms. They suggest that these MNEs face a LOF, because a lack of knowledge on the economic, political and cultural environment puts foreign firms at a disadvantage. This might be due to the institutional distance between the home and host country (see iii), but can also be attributed to differences in the ability of MNEs to exploit local economic opportunities.
- iii. If the MNE is from a country that is not a democracy (N_j^{LOF}), versus firms that are ($N_j^{\neq LOF}$). This argument follows Kostova and Zaheer (1999) and Eden & Miller (2004), who suggest that the institutional distance between countries is the key driver

behind LOF. Since all countries in Europe are democracies, we count MNEs from non-democratically ruled countries as MNEs that potentially face a LOF.

- iv. If the location choice of the MNE was in a non-contingent country, that was also a country with a different official language. MNEs that fall into this category (N_j^{LOF}) have a low probability of having prior knowledge on a country based on familiarity. This as opposed to MNEs that locate in a neighboring country and (or) a country by which they share an official language ($N_j^{\neq LOF}$). Eriksson et al. (1997) show that a lack of 'experiential knowledge', which they operationalize (among others) through the absence of foreign experience by the MNE and insufficient knowledge of a foreign language, results in a lack of local business and institutional knowledge. As such, these may increase the LOF.
- v. The genetic distance between the MNE's home and host country. Spolaore and Wacziarg (2009) show that the genetic distance, operationalized as the time elapsed since two populations shared a common ancestor, explains for current differences in income. The authors suggest that genetic differences introduce barriers to knowledge from the technological frontier, which subsequently hamper economic development. If these genetic differences are the root of structural economic differences between countries, they may also provide a source for a LOF. In particular, 'genetically distant' MNEs may face a LOF, because the lack of competitiveness in the MNEs home country market (due to a lack of technological development) influences the firm's ability to compete abroad (Porter, 1990).

We agree with previous researchers that operationalizing the LOF through home-host country differences, and relating these to lower level variables (regions), potentially introduces an ecological fallacy¹³ (Mezias et al., 2002). Although some MNEs may be better equipped to overcome a LOF (for instance, due to previous multinational experience), it seems unlikely that firms are completely impervious to large cultural, political and economic distances. Therefore, our approach might introduce some additional noise. Nonetheless, through this approach we are able to test the hypothesis. Second, for Europe we think that the regional level provides the best level of analysis to investigate differences in FDI. Basile et al. (2009) argue that MNEs increasingly view European regions with similar characteristics, but in different countries, as closer substitutes than dissimilar regions in the same country. This suggests that measuring cross-country differences in FDI is less relevant, as competition can occur equally between regions. We also refer to Rugman and Verbeke (2007) who provide a similar argument on the use of regional data versus cross-country data.

¹³Put simply: differences between countries do not necessarily explain differences between regions of the same set of countries, and vice versa. In general: characteristics of the group as a whole do not necessarily explain the characteristics of an individual element of the group.

Endogeneity

Concerns of endogeneity have often been expressed when relating economic outcomes to trust (Bjørnskov, 2006). In particular, reverse causality may bias the estimated coefficients. For instance, high levels of regional trust may attract MNEs, thereby lowering the rate of regional unemployment. Lindström (2009) argues that unemployment lowers an individual's perceptions on the trustworthiness of strangers. Therefore, low levels of unemployment due to high levels of regional trust could feed back into an individual's level of interpersonal trust, thereby increasing the average for a region. Second, current interpretations of the Uppsala model of internationalization explicitly state that firms should endogenously create the location advantages necessary for firm survival and performance. Although the development of regional trust typically is a long-term process, a relationship between MNE behavior and trust cannot be ruled out completely.¹⁴

To remedy potential problems of endogeneity between *Regional trust_j* and *N_j* an instrumental variables estimation is used. To allow for an unbiased estimation a number of instrument properties should be satisfied. First, the instruments should have a high correlation with the endogenous variable. Second, the interpretation of the correlation should be meaningful. Third, the instruments should not correlate with ϵ_i .

A large number of instruments satisfies the correlation argument. However, it is difficult to devise instruments that do not correlate with the number of greenfield investments. In this study, we propose to use the distance of each region to the equator. Durante (2009) argues that historically, climatic differences triggered the need for a more intensive form of cooperation for farmers further away from the equator (as opposed to farmers closer to the equator, which enjoyed less stringent climates). The author shows that this has had a persistent effect on the current levels of trust in both types of societies (with the effect being more positive when societies are further removed from the equator). It is highly unlikely that MNEs take the distance to the equator directly into account when choosing an investment location.¹⁵

Previous research suggests that distances to the equator may affect economic development (Engerman and Sokoloff, 1997). However, concerning the location choice decision there is evidence that MNEs view the cross-country regions of the European Union as being relatively similar (Basile et al., 2009). The effect of the instrument, therefore, is expected to only explain the differences in regional trust. Second, if the distance to the equator correlates with economic circumstances that are relevant to the MNE, then this effect is most likely captured by the right-hand side variables from Equation 3.1. What remains, then, is the 'social' effect of the distance to the equator.

¹⁴For instance, Zaheer and Nachum (2011) explicitly state that firm-specific resources, appropriated from the location, may spill back to the generic (observable) resources of the region, but at a higher level of quality (p.101).

¹⁵The use of this instrument has also proved popular in the literature on institutional quality and economic growth. See for instance Hall and Jones (1999) and Coviello (2003).

Additional note

We acknowledge that previous research often uses choice models, such as logit choice models, to model the location choice of MNEs. In the current study, this would add econometric complexity in terms of controlling for the potential endogenous relationship between the location choice and trust. However, Guimarães et al. (2003) and Schmidheiny and Brülhart (2011) show that the coefficients from a logit choice model can be equivalently estimated using count regressions. Such regressions straightforwardly allow the inclusion of instrumental variables, and are therefore preferred in the current study.

3.4 Data

3.4.1 ESS data

This study uses data from the European Social Survey (ESS¹⁶) to measure the main independent variable, *Regional trust*. The ESS is a bi-annual individual-level survey (for individuals ages 15 and above) which is issued in 34 Eurasian countries. Data are collected through face-to-face interviews with representatives of national ESS 'coordination teams' (these representatives are typically affiliated with public universities or national statistics offices). Note that the ESS is not a panel study, but instead surveys a random cross-section of the population of each country for each two-year wave. Data from the period 2003 to 2011 was used (wave 1 to 5). Although the maintainer of the ESS, the Norwegian Social Science Data Services, provides the data per wave (which roughly holds 2 years of data), the individual-level data identifies the exact year in which a respondent was surveyed. Additionally, despite the fact that each wave consists of two years, some countries have respondents in both 'wave-years'. This is dependent upon the choice of the coordination team. For instance, in Belgium the first ESS wave was conducted in 2002. However, the third wave was partially conducted in 2006 *and* in 2007.

For this study, these data were averaged per European region. This choice was motivated by the unequal interview periods, which render a true panel analysis unfeasible (i.e. the data is very unbalanced, even when aggregated on the country level). This approach yields a single 'average' region estimate for each survey statement for the period 2003-2011. The ESS region nomenclature was transformed to NUTS1 regions (Nomenclature of territorial units for statistics) using the conversion tables from Rózanska-Putek et al. (2009). NUTS is a hierarchical geo-coding system, largely based on a region's economic activities and population. NUTS1 regions are classified as major socio-economic regions and hold between 3 and 7 million inhabitants. Whenever the number of participating individuals per year in a region would drop below 50 the region-year combination was not considered for aggregation. As a result, 84 NUTS1 regions were available (currently, the European Union has 97 NUTS1 regions in total). Furthermore, in some countries the choice of cohorts is

¹⁶<http://www.europeansocialsurvey.org/>

not entirely random. To correct for this, all variables were weighted using the ESS-specific approach as described by Lynn et al. (2007).

Unless specifically noted, all other variables used in this study were similarly averaged (single average value for 2003-2011).

3.4.2 Detrending

Because a single data point is used for each variable for the period 2003-2011, some variables were linearly detrended prior to averaging. Where applicable, the following regression was first estimated:

$$x_{i,t} = \beta_0 + year_t + \varepsilon_{i,t},$$

with x_i the specific variable, and $year_t$, a dummy (0,1) for each year between 2003 and 2011. The detrended variables used in Equation 3.1 are equal to the average $\varepsilon_{i,t}$ from this equation ($\frac{\varepsilon_{i,t}}{t}$).

3.4.3 Variable descriptions

Greenfield investments

The Financial Times fDi Markets¹⁷ database holds regional data on worldwide cross-border investments. The total number of cross-border greenfield investments per NUTS1 region are extracted for 24 European countries (excluding mergers, acquisitions and joint ventures) for the period 2003-2011. A total of 25,808 greenfield investments were conducted in the investigated period. FDI data are recorded based on formal media announcements, industry organizations, financial information providers and market and publication companies. Approximately 90% of all investment projects are validated with company specific information sources. Although the database holds information on all investments, investment projects which create less than 10 new jobs, as well as investments involving less than \$1 million are relatively uncommon as these are usually not publicly announced.

Data were summed and aggregated per NUTS1 region, and log transformed (base e). The distinction between the per capita number of MNEs per NUTS1 region that potentially face a LOF (N_j^{LOF}) and those MNEs that do not ($N_j^{\neq LOF}$) is derived from the Financial Times fDi Markets data as follows:

- i. **Distance** The average home-host country difference in the fDi markets data is 3200km.¹⁸ MNEs that traveled more than this number were counted as MNEs that potentially face a LOF (N_j^{LOF}). A total of 11,235 investments fall into this LOF category.

¹⁷ Available at <http://www.fdimarkets.com/>

¹⁸ Calculated from the location coordinates available from the data using the R library 'fields' (Furrer et al., 2013).

- ii. **E.U.** MNEs from outside Europe were counted as MNEs that potentially face a LOF (N_j^{LOF}). A total of 11,826 investments fall into this LOF category.
- iii. **Democracy** We use the 'Revised Combined Polity Score' from the PolityIV data, which is a cross-country measure on the regime type from provided by the Center for Systemic Peace¹⁹. It holds three scoring ranges: -10 to -6 (autocracy), -5 to 5 (elitist-group rule), and 6-10 (democracy). The average measure if a home country is a democracy (PolityIV score ≥ 6 , $N_j^{\neq LOF}$) or not (score < 6 , N_j^{LOF}). A total of 1,136 investments fall into this LOF category.
- iv. **CEPII** We use the CEPII GeoDist database (Mayer and Zignago, 2011), which holds bilateral trade (and related) distances between countries. To construct the LOF sample (N_j^{LOF}) we choose MNEs that located in a non-contingent country, that was also a country with a different official language. A total of 1,012 investments fall into this LOF category.
- v. **Genetic** Spolaore and Wacziarg (2009) provide worldwide data on genetic distance, measured as the frequency of occurrence of 128 alleles (versions of a gene). We chose the bilateral genetic distance based on each country's dominant genetic group. The distance takes a value of zero if the allele distributions are identical across two countries. The average genetic distance in the world is 1177 alleles. When the genetic distance between the home and host country is beyond this value, it is counted as N_j^{LOF} . A total of 1,375 investments fall into this LOF category.

Regional trust

Data on 24 European countries were collected from the European Social Survey (ESS)²⁰ for the years 2003-2011. The survey presents individuals with the question: "Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?". Respondents are asked to rate the extent to which they agree with the statement on an 11 point Likert scale (where 0 indicates that "You cannot be too careful", and 10 indicates that "Most people can be trusted"). Furthermore, we note that this survey statement has previously been shown to relate to outcomes from trust-game experiments (Glaeser et al., 2000; Naef and Schupp, 2009; Sapienza et al., 2013).

Location control variables

Dunning (1998; 2008) provides four motivations for engaging in FDI: (i) access to resources; (ii) access to new markets; (iii) efficiency-seeking; and (iv) access to strategic assets. The following variables are added to control for each location's competitive advantage concerning these motivations.

¹⁹<http://www.systemicpeace.org>

²⁰ESS Round 1-5, Norwegian Social Science Data Services, Norway. The most recent version of each of the data files was obtained from <http://www.europeansocialsurvey.org/>

Resource-seeking FDI To control for resource-seeking motives the share of employment in the mining and quarrying sectors per region (as a share of total employment), *Employment mining (share)*, was extracted from the Cambridge Econometrics database.²¹ Data were detrended prior to averaging.

New market-seeking FDI To control for the purchasing power per region, as well as the relative importance of wages in the MNE's decision to invest abroad, the *GDP per capita* in Euro (2000 constant prices, detrended) was extracted from the Cambridge Econometrics database. Furthermore, we control for a region's accessibility by air and accessibility by rail and road. These variables are defined as deviations from the average accessibility per region (where a score of 100 indicates the average), and are constructed by the European Observation Network for Territorial Development and Cohesion (ESPON).²² For both variables, 38 regions score above the European average (i.e. are better accessible). Both variables were added, yielding the variable *Transport infrastructure*. Finally, the variable *Distance to seaport (per 100 km.)*, obtained from ESPON, was added.

Efficiency-seeking FDI To control for differences in the number of greenfield investments due to differences in tax rates the *Corporate tax rate* is added. It holds the tax rate (in percentages) per country, and is derived from the Ernst and Young Worldwide Corporate Tax Guide. There exist large differences in tax rates among the sample. For instance, the maximum rate (35.75%, Germany) is three times higher than the lowest rate (11.25%, Cyprus).

Strategic asset-seeking FDI Each region's *R&D expenditures (% of GDP)* was added from Eurostat to control for strategic asset seeking motives. Furthermore, to control for the level of human capital of the region the variable *University (%)* was recorded from Eurostat. It holds the share of population (>15 years) with a university degree (ISCED²³, levels: 5-6) per NUTS1 region.

Additional control variables

Although the NUTS1 nomenclature aims to measure regions of similar size and economic power, differences do exist. We take the *Total employment (rel.)*, defined as the region's total employment (Cambridge Econometrics) divided by the sample average total employment, to control for the fact that some regions simply house more working individuals, and may potentially accommodate more MNEs.

Instrument

We take each region's latitude coordinate as proxy for the *Distance to the equator*. Higher values correspond to locations that are more northern.

²¹Obtained through <http://www.camecon.com/>

²²Available at <http://www.espon.eu/> A more elaborate description of the construction of these variables can be found in Spiekermann and Wegener (2006).

²³See Schneider (2008).

An overview of the aforementioned variables, including summary statistics, is presented in Table 3.1. Notice that there is a large difference in the minimum and maximum values for the number of greenfield investments, and the values for regional trust. Finally, a correlation matrix is presented in Appendix 3.B.

	Mean	St. Dev.	Min	Max
<i>Dependent variables</i>				
No. of Greenfield investments	307.24	291.15	16	1,814
No. of Greenfield investments (LOF: distance)	133.75	179.24	1	1,335
No. of Greenfield investments (\neq LOF: distance)	173.49	140.74	12	702
No. of Greenfield investments (LOF: EU)	140.79	185.60	1	1,383
No. of Greenfield investments (\neq LOF: EU)	166.45	134.17	13	674
No. of Greenfield investments (LOF: democracy)	13.52	19.61	0	129
No. of Greenfield investments (\neq LOF: democracy)	293.71	276.01	16	1,685
No. of Greenfield investments (LOF: CEPII)	205.30	183.92	12	871
No. of Greenfield investments (\neq LOF: CEPII)	101.94	159.46	0	1,216
No. of Greenfield investments (LOF: genetic)	16.37	20.06	0	115
No. of Greenfield investments (\neq LOF: genetic)	290.87	274.72	15	1,722
<i>Control variables</i>				
Regional trust	4.82	0.68	3.3	6.9
Employment mining (share)	10.27	10.99	1.7	81.1
Gdp per capita	21,827.59	10,952.76	4,044.2	5,7743.5
Transport infrastructure	193.50	85.51	45.7	386.2
Distance to seaport (per 100 km.)	1.60	1.57	0.0	6.2
Corporate tax rate	0.29	0.06	0.1	0.4
R&D exp. (% of GDP)	1.50	0.88	0.3	4.2
University (%)	0.29	0.08	0.1	0.5
Total employment (rel.)	1.01	0.76	0.2	5.9
<i>Instrument</i>				
Distance to equator	49.30	6.02	28.4	63.1

Table 3.1: Descriptive statistics.

3.5 Results

3.5.1 Estimations

To test our hypothesis a series of seemingly unrelated negative binomial regressions are estimated using the previously described control variables and instruments. Seemingly unrelated regression takes into account the fact that the error (ε_j) for the N_j^{LOF} and $N_j^{\neq LOF}$ regressions are correlated.²⁴ A control function approach is used to model the endogenous relationship between the number of greenfield investments and the regional trust level. The exogenous estimate is obtained by saving the residual from a first-stage regression of all control variables from the model (including the instrument *Distance to Equator*) on *Regional trust*. First-stage regressions are provided in Appendix 3.C. Where applicable, variables have been transformed logarithmically (base e). Estimation results are posted in Table 3.2 on page 58. For comparative purposes, a baseline model for the complete sample is provided (i.e. without an operationalization of the LOF). The estimations using LOF samples (estimations 2-6) are printed in the left column (right column: $N_j^{\neq LOF}$). Heteroskedasticity robust standard errors are calculated.²⁵ At the bottom of the table the result of a Wald-test for equal coefficients on *Regional trust* is printed (H1: coefficients for the estimation using $N_j^{LOF} > N_j^{\neq LOF}$).

The variable *Regional trust* is consistently positive across all equations. The baseline model shows that MNEs locate more often in regions with higher levels of *Regional trust*. Given that the control variables are held constant, a one unit increase in *Regional trust* increases the expected log-count of the *No. of Greenfield investments* by 0.5. In terms of incidence ratios, this amounts to a factor 1.65 (i.e. a one unit increase in *Regional trust* increases the number of investments by this factor).

In models 2-6, we test whether this finding is related to the liability of foreignness. The effect between LOF and non-LOF samples is clearly visible: if the samples are split, the difference in coefficients between the equations for N_j^{LOF} and $N_j^{\neq LOF}$ for the *Regional trust* variable is substantial. For instance, although there is a positive effect for both 'Democracy' samples, the effect is 0.28 expected log-counts larger for firms potentially facing a LOF (0.77 versus 0.49, or in ratio terms: 2.17 versus 1.63). Furthermore, the Wald-test shows that this difference in coefficients is significant at the 10% level. MNEs from non-democratic countries more frequently locate in high-trust regions than firms from democratic countries. The effect of the CEPII sample is perhaps the most striking: firms that located in a region in a non-contingent country, without sharing a language, did virtually exclusively seek out regions with high levels of trust. In comparison to the baseline model, this suggests that firms facing this particular LOF drive the positive effect of *Regional trust*. Expressed as incidence ratio, each unit increase in *Regional trust* doubles the amount of MNEs that face

²⁴Strictly speaking, performing two separate negative binomial regression will yield the same results because the right-hand side regressors are the same across both equations. However, using a system of equations allows to straightforwardly perform a Wald-test on the equality of coefficients across equations to test our hypothesis.

²⁵To test for spatial serial correlation in the location choice of MNEs Moran's I was calculated (Moran, 1950). The null hypothesis of zero spatial serial correlation was not rejected ($p=0.40$).

this particular LOF. Similarly, firms that are categorized as potentially facing a LOF in the 'Genetic' sample more often locate in high-trust regions. The effect almost doubles between samples. Expressed as incidence ratio, a one unit increase in *Regional trust* increases N_j^{LOF} by a factor 2.5, over 1.6 for the $N_j^{\neq LOF}$ sample.

A similar picture emerges for the other samples, although the significance of the effect depends on the specific sample. MNEs with a high probability of facing a LOF -whether based on the home-host country distance, not being a member of the E.U., not being a democracy or the genetic distance- indeed locate more often in regions where trust is high. For most samples, the effect of the level of regional trust is not exclusive to firms facing a LOF: the effect for the $N_j^{\neq LOF}$ samples is also positive and significant. This suggests that overcoming the LOF is but one mechanism through which the regional trust level operates: it is not the only mechanism. If the level of regional trust positively correlates with the quality of the local workforce (institutional quality), which in itself is not exclusively demanded by MNEs facing a LOF, then this result seems reasonable. However, the difference between coefficients for the N_j^{LOF} and $N_j^{\neq LOF}$ samples shows that in part this is caused by differences in the local 'nonobservable' business climate.

Furthermore, the results show that this finding is robust against endogeneity. The variable in the first-stage regression has the expected sign: *Distance to equator (Log.)* is positively related to regional trust (i.e. regions further away from the equator have higher trust levels). Therefore, we do not reject our hypothesis. Regions with a business climate that is valued by MNEs, captured here by the level of regional trust, clearly have a higher probability of attracting greenfield investments. Judged by the differences in the magnitude of the coefficients across samples, this effect is indeed more pronounced for firms facing a LOF.

	(1) Base	(2) Distance	(3) E.U.	(4) Democracy	(5) CEPII	(6) Genetic
Regional trust	0.50*** (0.18)	0.62*** (0.23)	0.57*** (0.21)	0.77*** (0.27)	0.72*** (0.16)	0.92*** (0.30)
Employment mining (share)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.02)	-0.00 (0.01)	0.01 (0.01)
Log. Gdp per capita	0.24 (0.21)	0.63** (0.29)	0.53** (0.27)	0.04 (0.26)	-0.10 (0.19)	0.27 (0.33)
Log. Transport infrastructure	0.65*** (0.21)	0.94*** (0.25)	0.94*** (0.24)	1.11*** (0.31)	0.68*** (0.20)	1.25*** (0.28)
Distance to seaport (per 100 km.)	0.10 (0.06)	0.11 (0.07)	0.10 (0.07)	0.10* (0.09)	0.07 (0.06)	-0.01 (0.08)
Corporate tax rate	-8.33*** (1.47)	-9.58*** (1.76)	-9.58*** (1.70)	-8.78*** (2.27)	-6.35*** (1.41)	-8.41*** (2.13)
R&D exp. (% of GDP)	0.04 (0.09)	-0.01 (0.10)	0.09 (0.09)	0.08 (0.11)	0.11 (0.09)	-0.17* (0.11)
University (%)	1.24 (1.07)	2.09 (1.38)	2.24* (0.99)	1.92 (1.20)	1.00 (1.04)	2.45 (1.68)
Total employment (rel.)	0.58*** (0.20)	0.61** (0.17)	0.62*** (0.24)	0.74** (0.32)	0.55*** (0.18)	0.50* (0.27)
Constant	3.45*** (1.03)	1.15 (1.26)	1.19 (1.20)	3.52*** (1.43)	2.35** (0.95)	-2.87** (1.40)
Observations	84	84	84	84	84	84
Greenfields	25,808	11,235	11,826	1,136	17,245	1,375
AIC	1083	938	945	576	1076	614
BIC	1109	965	971	602	1039	641
Wald (p)	-	0.10	0.20	0.08*	<0.01***	<0.01***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.2: Seemingly unrelated negative binomial I.V. model for dependent variable: No. of *Greenfield investments*. Instrument for *Regional trust*: *Distance to equator*. LOF models (2-6): N_j^{LOF} is left column, $N_j^{\#LOF}$ is right column. Heteroskedasticity robust standard errors in parentheses. Wald-test (H1: coefficient on *Regional trust* for N_j^{LOF} sample $> N_j^{\#LOF}$) is printed at the bottom.

What follows is a short treatment of the control variables. We focus on the baseline model, as the estimated coefficients across sample specifications can differ slightly. First, regions with larger natural resources, measured by *Employment mining (share)*, on average attract less greenfield investments. The variable *Log. GDP per capita* shows that regions with higher per capita income attract more greenfield investments. The quality of a region's infrastructure as measured by *Log. Transport infrastructure*, significantly explains differences in the number of greenfield investments (with a positive coefficient), whereas *Distance to seaport (per 100 km.)* does not. The *Corporate tax rate* bears a negative sign and is significant, indicating that locations with lower tax-rates are preferred by MNEs. The variables pertaining to Strategic asset-seeking FDI, *R&D expenditures (% of GDP)* and *University (%)* do not significantly affect the number of greenfield investments for most samples. Finally, larger regions (in terms of employment) attract a larger number of investments (*Total employment (rel.)*).

In general, it seems that quite some of these 'traditional' location choice variables do not affect the number of investments. However, just as the effect of *Regional trust* is not exclusive to helping MNEs overcoming a LOF, so do high values of trust correlate positively with some of these variables (such as *University (%)* and *Log. GDP per capita* which have relatively high correlations²⁶). In general, it is difficult to abstract the effect of trust without simultaneously picking up effects of variables that are related to it.

3.5.2 Limitations

An important limitation of the current study is that it treats each greenfield investments as intrinsically equal. To zoom in on the LOF problem, we have intentionally left out a large fraction of firm heterogeneity. Therefore, a number of questions can arise. For instance, it can be argued that the LOF argument will not be of equal impact for all internationalizing companies. For instance, consider the difference in horizontal and vertical foreign direct investments (Navaretti and Venables, 2004). With horizontal FDI, a firm 'duplicates' abroad a number of its activities conducted in the home country. The main trade-off faced by firms engaging in this type of investment is between the increased sales, strategic advantage and lower transport costs to be gained from operating abroad versus the forgone economies of scale at the home country. Vertical foreign investments are investments in which a firm decides to geographically disperse its activities by function, whereby some of its business activities are performed abroad. Here, the main trade-off is between the lower factor costs associated with investing abroad versus the increased trade costs and foregone economies of scale at the firm level. In terms of the costs associated with the LOF, managing multiple individual firm units across different countries and cultures (vertical investment) will prove harder than duplicating an existing firm abroad (horizontal investment).

Additionally, we have not taken into account policies designed by local governments or interest groups aimed to attract MNEs. Harding and Javorcik (2011) show that such policies may affect inward FDI. We suspect, however, that this effect is 'averaged out' in the current

²⁶Appendix 3.B.

empirical framework, as these efforts are increasingly streamlined by the European Union.²⁷

3.6 Conclusion

Why is there such a large difference in the inward flow of greenfield investments between similarly competitive regions in Europe? This study looks at the liability of foreignness (LOF) to explain why multinational enterprises (MNEs) prefer certain regions in Europe over others. For an MNE investing abroad introduces certain risks. Home-host country differences in the social, political or organizational culture of a foreign location may introduce information asymmetries when expanding to a foreign country. These differences introduce two categories of LOFs. LOFs from the environment external to the firm pertain to information asymmetries in the host-location's institutional environment (for instance, bribery and corruption). LOFs from the environment internal to the firm relate to the (potential) cultural mismatch between local employees and the home-country managerial culture, or with the inability of the MNE to embed itself in local business networks.

The central question in the literature on the internationalization process of firms has been: "How do MNEs overcome the LOF?". Contrary to previous research, we hypothesize that MNEs take the LOF into account in their location decision. We suggest that MNEs are able to 'measure' the probability of encountering a LOF (or the probability of encountering a LOF but overcoming it) by searching for elements in the location's business climate that mitigate the LOF. We use the level of regional trust as a proxy for a region's ability to mitigate the LOF. We provide empirical evidence that supports the view that this level may be inferred through two elements that offset the LOF problem: (i) through the effect of trust on the quality of the local institutions (for instance, by low levels of corruption and transparent laws) and (ii) through the effect of trust on the quality of the local workforce (through the positive effect of trust on entrepreneurship, innovation and network access).

The link between regional trust and the LOF is empirically tested for cross-border greenfield investments for 84 European NUTS1 regions (measured as number of investments per region between 2003-2011). Greenfield investments are investments by an MNE in a manufacturing or production plant, office or other operational facility, in an area where no such facility yet exists. Because greenfield investments are wholly owned by MNEs, these investments cannot directly benefit from locally available knowledge on potential LOFs (as opposed to MNEs engaging in joint ventures or mergers and acquisitions). Data on the number of investments and regional trust level are obtained from Cambridge Econometrics and the European Social Survey, respectively. Five separate samples are constructed, each consisting of a sub-sample with firms that probably will face a LOF, and those that probably will not. The following criteria are used to assess if an MNE potentially faces a LOF: (i) absolute home-host country distance, (ii) not being a member of the European Union, (iii) not being a democracy, (iv) not being contingent or sharing an official language and (v) the home-host country genetic distance. Our results show that, controlling for the competitive

²⁷See for instance the 2010 European Commission report "Towards a comprehensive European international investment policy" (available from <http://ec.europa.eu>) or Basile et al. (2008).

differences in each region, MNEs that potentially face a LOF indeed locate more often in high-trust regions. This effect is sizeable: when we do not take any LOF into account an increase of one in our measure of regional trust (ordinal scale: 1-10, higher score indicates a higher level of interpersonal trust) increases the average number of greenfield investment by a factor 1.65. This number increases when the probability of facing a LOF is operationalized: firms with a higher probability of facing a LOF more often locate in regions with a higher trust level. Furthermore, we use the distance to the equator as an instrument for the level of regional trust to show that these results are robust against endogeneity. Given the fact that Europe attracts a substantial amount of the flows of foreign direct investments in the world, as well as the fact that an increasing number of these firms are from countries outside the European Union (both in terms of geographic distance and culture), these findings shed new light on the location choices of multinational enterprises and the observed difference in regional attractiveness in Europe.

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Appendix 3.A Visual representation

Calhoun (2002) summarizes two streams of LOF: those related to the external (=institutional) and internal (=within the firm) environment (Figure 3.1). High-trust regions may signal that these LOFs are more easily overcome, because the quality of the institutional environment is higher in these regions (less corrupt government officials, transparent rules and regulations) or because they have an innovative, entrepreneurial workforce (Figure 3.2).

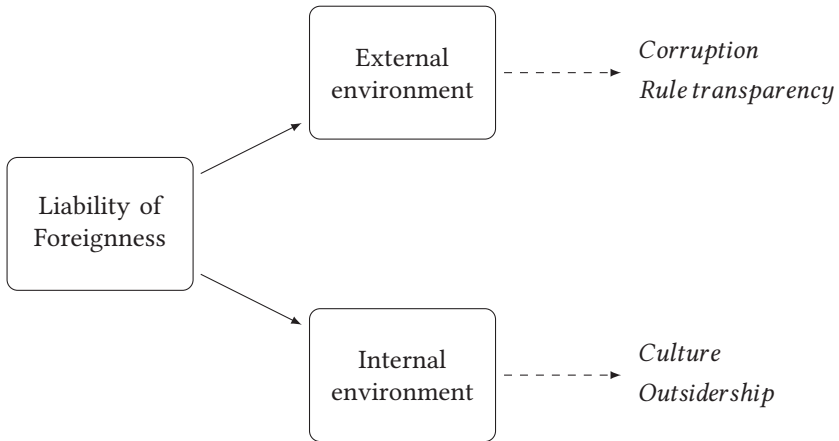


Figure 3.1: Liability of foreignness (source: Calhoun, 2002).

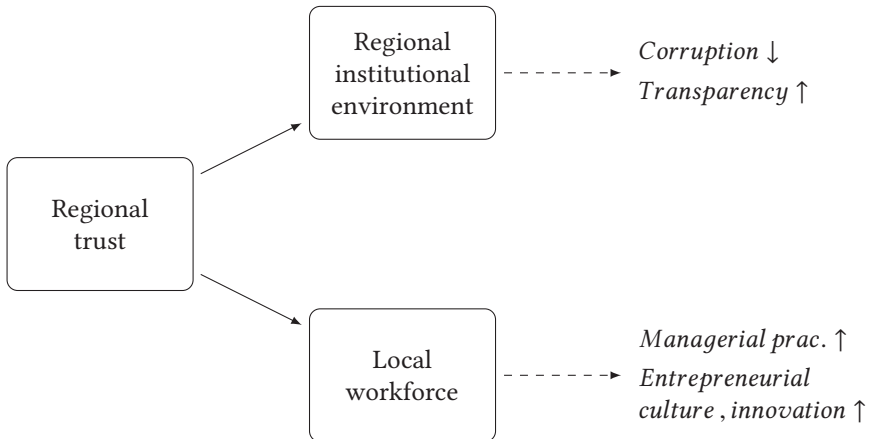


Figure 3.2: Regional trust ↑, LOF ↓.

Appendix 3.B Correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1.Regional trust	1.00								
2.Employment mining (share)	-0.23	1.00							
3.Log. Gdp per capita	0.57	-0.36	1.00						
4.Log. Transport infrastructure	0.11	-0.07	0.51	1.00					
5.Distance to seaport (per 100 km.)	-0.35	0.38	-0.54	0.12	1.00				
6.Corporate tax rate	0.08	-0.29	0.63	0.46	-0.36	1.00			
7.R&D exp. (% of GDP)	0.52	-0.08	0.57	0.42	-0.10	0.35	1.00		
8.University (%)	0.49	-0.05	0.47	0.22	-0.32	0.21	0.39	1.00	
9.Total employment (rel.)	-0.10	0.56	0.13	0.25	0.02	0.14	0.16	0.25	1.00

Table 3.3: Correlation matrix

Appendix 3.C First-stage regression

The result from the first-stage OLS regression is posted in the following table. Heteroskedasticity robust standard errors are printed in parentheses. The expected effect is found: regions that are further removed from the equator have significantly lower levels of interpersonal trust. Judging by the value for the F-statistic (>10) a weak instrument bias is not to be expected (Stock and Yogo, 2005).

	(1)
Distance to equator	0.06*** (0.01)
Constant	2.07*** (0.62)
Observations	84
R^2	0.24
F(1,82)	18.89

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.4: First-stage OLS model for dependent variable: *Regional trust*. Heteroskedasticity robust standard errors in parentheses.

“Trust men and they will be true to you; treat them greatly, and they will show themselves great.”

Ralph Waldo Emerson, 1803-1882

4

Does interpersonal trust increase productivity?

An empirical analysis between and within countries

4.1 Introduction

Economists have become increasingly aware of the positive relation between interpersonal trust and economic performance. Trust, or “*the belief that others will not deliberately or knowingly do us harm, if they can avoid it, and will look after our interests, if this is possible*” (Delhey and Newton, 2005, p. 311), is central to a well-functioning modern economy that is based on a multitude of social and economic interactions between non-kin individuals (Fukuyama, 1995). In particular, trust has been proposed as a possible explanation for the observed differences in economic growth and development between countries and regions (Knack and Keefer, 1997; Schneider et al., 2000; Whiteley, 2000; Zak and Knack, 2001; Casey, 2004; Dincer and Uslaner, 2009).

Broadly speaking, two theoretical mechanisms for modeling the economic effects of trust are used. The first treats trust as a skill: a labor specific moderator for risky interactions (i.e. those involving incomplete information or information asymmetries) (Seligman, 1998). Here, the economic effect of trust is usually equated with a higher rate of economic growth due to a higher propensity to innovate for high-trust societies (mainly, because trust reduces costs associated with monitoring agents). The second mechanism identifies trust as a capital specific moderator. This view is grounded in the network view of economic interactions (Lin, 1999), stating that investments in social relations allow individuals access to embedded resources within these networks. From a theoretical standpoint, this conceptual dichotomy

is straightforward: when viewed as a skill, trust has the ability to increase the productivity of labor. When viewed as a characteristic of a network of individuals, trust potentially increases the productivity of capital through lowering the costs of searching or acquiring productive resources.

Unfortunately, the empirical investigation of both mechanisms has largely occurred separately or through frameworks that do not explicitly allow to unify these theoretical mechanisms. This might explain the many contradictory results in the literature on the macroeconomic significance of interpersonal trust, in particular for studies using Barro-type growth equations results (Berggren et al., 2008; Westlund and Adam, 2010).¹ A number of explanations for the reporting of these mixed results can be put forward. First, growth equations are not necessarily accurate reflections of production growth for non-steady-state economies. When comparing low-developed countries (with a high potential for growth) with developed countries, which often similarly correspond to low an high-trust countries, differences in cross-sectional growth rates are potentially meaningless (Eberhardt and Teal, 2011). Second, the growth of GDP or employment does not automatically translate into a growing wealth of nations. For instance, although a large middle class positively influences growth, an increasing portion of aggregate growth is nowadays usurped by a decreasing number of individuals for many developed countries, thereby distorting the distribution of wealth (Easterlin, 2000; Solt, 2009). Alternatively, the importance of subjective well-being over objective well-being (for instance, the choice of leisure over income) may prompt reductions in total work hours for individuals without sacrificing (subjective) wealth. This may nonetheless flatten economic growth. Third, if both labor and capital may benefit from high levels of trust then empirically disentangling either of the two effects is ambiguous from a theoretical standpoint, let alone challenging from an econometric perspective.

A potential solution to these problems is to identify the economic effect of trust in a more general framework: one that eliminates the need to zoom in on a single mechanism, while retaining an informative economic interpretation of trust. In this respect, the workhorse model of productivity analysis, the Solow model for technical change and aggregate production (Solow, 1957), provides a more unified approach for measuring the impact of variables that fall outside its (elegantly simple) functional form. While labor (L) and capital (C) are used to model aggregate output, the model provides for a shift parameter (A) that allows to measure productivity differences which are not directly related to both inputs. This parameter, referred to as the total factor productivity (TFP) or Solow residual (depending on how it was derived from the model), is a catch-all variable capturing the 'unanticipated' distortion in productivity. By relating the quantification of this 'manna from heaven' to trust, an empirical test of the economic significance of trust that acknowledges its potential effect on both labor and capital (without specifying the exact mechanism) is feasible.

Despite this intuitively appealing approach empirical analysis using TFP and social aspects of societies are sparse. In a robustness analysis accompanying their seminal con-

¹I explicitly mention here that a positive relationship between trust and economic outcomes is confirmed, however, the significance of the relationship is often questioned.

tribution, Knack and Keefer (1997) relate trust to *TFP* and find a positive but insignificant effect. In a similar cross-sectional analysis, Hall and Jones (1999) find a positive relationship between *TFP* and 'social infrastructure'. However, the latter is constructed to (predominantly) measure the positive economic effects of institutions. In a recent working paper, Bjørnskov and Méon (2010) model the relationship between trust and *TFP*. However, their analysis is limited to a cross-section of countries and does not take into account the development of productivity within countries (in relation to trust).

This paper fills this void in the empirical literature on the economic significance of trust. I relate country-levels of interpersonal trust, measured as the percentage of the population expressing trust towards strangers (source: World Values Survey, 1990-2008), to *TFP* (source: Penn World Tables). Trust, here, is treated as a catch-all variable that may potentially affect productivity through (i) labor (where trust allows to reduce principal-agent problems related to asymmetric information), (ii) capital (where trust facilitates access to the embedded resources in networks of agents,) and (iii) the quality of institutions (which may improve the productivity of both labor and capital, and is affected by trust through the relative absence of bureaucratic rules, corruption or excessive rent-seeking). In a cross-sectional setting, I find that high-trust countries on average are more productive than low-trust countries. In a longitudinal setting, I similarly find that an increase in the percentage of high-trust individuals per country positively influences productivity, but only significantly so for (i) countries where productivity grew modestly (up to a growth of 0.15 in *TFP*), and (ii) relatively advanced economies (OECD member countries). This implies that the economic effect of trust is dependent upon certain *a priori* development conditions within countries. Potentially, these are related to the development of interpersonal trust, such as through a free market economy and democratic political system. This may explain why empirical analysis using growth often find contradictory results: the economic effect of trust is simply not universal. Finally, I show that these results are robust against endogeneity by suggesting that the trust level is dependent upon the ability of a society to inform itself on the appropriate amount of trust to hold (*vis-à-vis* strangers). Two instruments are used. The first measures if the country has a monarch at the head of the state. Kings and queens often have a role model function through which they inform the public on the appropriate forms of conduct (for instance, by addressing wrongdoings in public speeches). The second measures the number of daily newspapers in circulation per country. Newspapers similarly scrutinize individual actions or social relations, and thus provide information on the appropriate trust level for a society. Although the results in the cross-sectional analysis hold against endogeneity, the results from the longitudinal analysis unfortunately suffer from a weak-instrument problem. In this respect, it is suggested that future research addresses the exact mechanisms through which interpersonal trust grows. Nonetheless, the coefficients bare the expected signs and do not invalidate the hypothesized relationship between interpersonal trust and productivity.

The remainder of this paper is organized as follows. Section 4.2 provides a theoretical framework for trust and its relation to productivity. Section 4.3 presents a framework for the empirical strategy. Section 4.4 deals with the data and variable operationalizations. In

section 4.5, I present the methods, models and estimation results. Finally, conclusions are reported in section 4.6.

4.2 Theoretical framework

Productivity is generally defined as the amount of input needed for a certain amount of output. In a macroeconomic sense, these variables are usually operationalized as capital and labor, which together produce a country's total output or gross domestic product. Despite having similar factor endowments there are large differences in the output of countries, suggesting that levels of productivity differ substantially (Acemoglu and Zilibotti, 2001; Acemoglu and Dell, 2010). The next sections motivate why interpersonal trust is a good candidate for explaining (parts) of these differences. The effect of trust on the productivity of labor and capital are described. Following Hall and Jones (1999), the effect of institutional quality on productivity is also discussed. However, the latter effect is directly related to interpersonal trust.

Trust and the productivity of labor

The first economic effect of trust that is recognized is its (theoretical) effect on the productivity of labor. Many economic interactions, in particular those related to principal-agent relationships, introduce problems of incomplete or asymmetrical information. A classical example is the absence of information on the alignment of an agent's true motivations with those of the principal. A potential mechanism to bridge this asymmetry is a contract: a formal agreement between both actors that ensures that misaligned behavior (for instance shirking) is avoided.

However, contracts have economic costs. Apart from the added bureaucracy, there is the costs of writing, monitoring and enforcing the contractual agreements. For many economic exchanges, the sheer costs associated would make contractual agreements infeasible. Butler et al. (2012) describe a typical example of such an economic interaction: taking a cab in a foreign city. An individual may not necessarily know his way around a city. Also, he may be under the impression that there is a possibility that a taxi driver will take a scenic route in order to inflate the price for the fare. On the other hand, the taxi driver may simply be motivated to take the shortest route possible, so that he can provide his services to many more taxi-seeking individuals. Similarly, the taxi driver has no information on the creditworthiness of his passenger: the individual may quite literally be a 'free rider'. For both individuals, the decision to get into the taxi ultimately is dependent on trust. Here, trust is "*the acceptance of dependency in the absence of information about the other's reliability, in order to create an outcome otherwise unavailable* (Barbalet, 2009, p. 367)." Trust allows to maintain the interaction *despite* the fact that there is no information on the expectation of the outcome in a certain situation (Seligman, 1998).

There is ample empirical evidence on this specific economic effect of trust. For instance, in a laboratory setting interpersonal trust replaces the need for contracts (Ben-Ner and

Putterman, 2009). The latter leads to higher payoffs in the investment game played by the participating individuals. Furthermore, trust allows to decrease the transaction costs for economic exchanges between firms by (partially) substituting for the negotiation, monitoring and enforcement of contracts (Ring and van de Ven, 1992; Gulati, 1998). For complex collective action problems, which suffer a great deal from incomplete information, trust facilitates the reaching of agreements and consensus (Ostrom, 1990, 2000; Alesina and La Ferrara, 2005).

From the perspective of productivity in the Solow framework, trust may reduce labor-specific costs while maintaining a similar level of output. However, as pointed out by Knack and Keefer (1997), it may additionally allow the redirection of resources towards innovative activities. For instance, time normally spent to monitor agents could be redirected towards the development of product or process innovations, which could in turn increase the output level of firms. This would, however, not be *directly* visible in the *L* part of the framework. Therefore, it seems reasonable to assume that countries with a large share of high-trust individuals may improve the productivity of labor through an unspecified shock through *TFP*.

Trust and the productivity of capital

Second, trust may also affect the productivity of capital. This view is best appreciated by adopting a network view of economic interactions. Lin (1999) states that investments in social relations allow individuals access to embedded resources within networks. Such resources may be tacit (for instance: knowledge on managerial best practices or profitable business opportunities) or explicit (for instance, access to financial sources that allow for productivity investments). The network-specific capital that forms in this process is in the literature often referred to as *cultural capital* (Bourdieu, 1980) or *social capital* (Putnam et al., 1994; Fukuyama, 1995). The currency to access these networks (and also to survive within) is trust.

In a laboratory setting, Cagno and Sciubba (2010) confirm that trust influences the formation of social networks: trust determines the membership and (long term) profitability of a network position. Lin (1999) provides a number of explanations for this positive economic effect of social networks.² First, social networks increase the flow of information between actors. This information may in turn increase productivity and growth. For instance, Uzzi (1996) shows that firms are better able to exploit growth opportunities if they operate within cooperative networks of firms. Inkpen and Tsang (2005) show that between-firm knowledge transfers are positively affected by trust. Laursen et al. (2012) show that trust facilitates intra-firm knowledge spill-overs on product and process innovations for 21 Italian regions. Second, social networks may provide access to otherwise inaccessible resources. Such resources may be tacit, or explicit. Tsai and Ghoshal (1998) argue that trust

²Although this section focuses on the productivity of capital, some of these explanations may also hold for explaining differences in the productivity of labor. However, as argued in the introduction this is precisely why the current study takes a more general approach in relating trust to economic outcomes. I will elaborate on this stance in the concluding part of this section.

increases within and between-firm resource sharing, thereby increasing the probability for product and process innovations. Guiso et al. (2004) relate financial development to social capital for Italian regions, claiming that individuals in high-trust regions more often engage in high-trust financial interactions, such as lending money from banks (as opposed to lending from relatives) or holding stocks. The effect of trust, here, potentially reinforces productivity: money flows to regions with high levels of trust, under the assumption that it will also secure a return on investment. A positive return is only possible if the productivity in a certain region is higher than elsewhere. Related to this finding, Uzzi (1999) shows that firms more easily acquire financial capital (lower search costs) and at lower interest rates if they are embedded within a network of firms and financial institutions (as opposed to being a atomistic element, only capable of securing arm's length financial arrangements).

From the perspective of productivity, two broad statements can again be made. Trust facilitates access to social networks. These networks (i) may reduce the search costs for tacit and explicit resources (costs which then may be reverted to productive purposes), or (ii) provide access to resources that may directly (knowledge on innovations) or indirectly (lower search costs of capital) influence productivity.

Trust and institutional quality

A third category of mechanisms through which trust may affect economic outcomes can be identified through the effect of trust on the quality of institutions (Bjørnskov and Méon, 2013). However, it should be noted that this effect will most likely be related to either labor or capital. For instance, through a superior implementation of checks and balances high-trust societies are able to limit corruption, exploitation, and theft which potentially increases the propensity of individuals to invest in capital intensive goods (Hall and Jones, 1999). Furthermore, trust supports the development of sound financial institutions which similarly increase the propensity to acquire capital (Guiso et al., 2004). Also, the quality of institutions may promote inward foreign direct investments, thereby increasing the chance that productivity-enhancing knowledge from the technological frontier spills over to a host country or region (Keller, 2001; Alguacil et al., 2011). Finally it is suggested that high-trust societies are better able to create high levels of human capital through better educational institutions (Coleman, 1988; Knack and Zak, 2003). Here, trust would have an effect on the productivity of labor.

Previous research shows that there is a direct relationship between the quality of institutions and productivity. For instance, Hall and Jones (1999) find a positive relationship between total factor productivity and 'social infrastructure'. The latter measures institutional quality, and aims to control for the rent-seeking propensity of a society. Countries that are better able to avoid rent-seeking have higher productivity levels (presumably, because a larger share of capital and labor is used productively instead of in an exploitative manner). Furthermore, Chanda and Dalgaard (2008) find that efficiency differences across sectors can be explained for by differences in protection of property rights and financial development. Similarly, Scarpetta et al. (2002) find that more stringent regulatory settings hamper productivity. In terms of the educational environment, Guellec and Van Pottels-

berghe de la Potterie (2004) show that investments in public R&D (government research agencies and universities) indeed increases a country’s productivity. Finally, Edwards (1998) uses governmental trade policies to show that more open countries also have higher levels of productivity.

In short, trust may affect the institutional quality which, in turn, may affect the productivity of labor (i.e. through education) and (or) the productivity of capital (i.e. through promoting FDI).

Hypotheses: trust and productivity

The following chart, Figure 4.1, summarizes the previously discussed literature on the effects of trust.

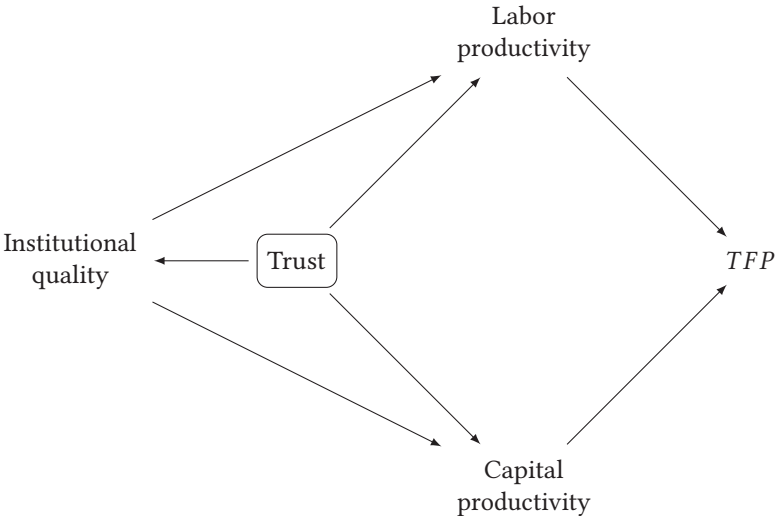


Figure 4.1: Theoretical relationship between trust and total factor productivity, *TFP*. Potentially, trust can affect both labor and capital. However, as argued in the introduction this dichotomous view on the economic effect of trust is not pursuit here. Instead, this paper will focus on the direct effect of trust on *TFP*, *assuming* that trust may affect either. The arrow between Trust and Institutional quality indicates that trust may affect the quality of the government, for instance by reducing corruption. The latter may have a direct effect on labor and capital, for instance by a higher quality of labor (education) or through government policies that promote inward foreign direct investments.

In the introduction it was argued that the economic effect of trust may be better appreciated through a model that does not explicitly take into account its exact productive

purpose (capital *or* labor). The idea, here, is that trust simply improves the total factor productivity, either by directly improving both factor inputs or by facilitating a high-quality institutional framework that itself promotes productivity. In this sense, trust acts as a 'catch-all' variable that aims to capture all of the causal paths as drawn in Figure 4.1. In short, this translates to investigating the following relationship:

$$\text{Trust} \rightarrow \text{Total Factor Productivity (TFP)}.$$

Arguably, this approach may add noise to the analysis. However, as observed by Westlund and Adam (2010), the positive effect of trust is only consistently found in relatively isolated micro-studies dealing with either capital or labor (for instance, in within or between company studies where N is typically small). This suggests that the strength of one of the single effects may be attenuated in studies focusing on macro circumstances. Consequently, this may explain the mixed results from various studies relating trust to economic growth (Berggren et al., 2008). Therefore, it makes sense to adopt a less fine grained view on the effect of trust: one that allows to demonstrate the concept's general economic significance. In this sense, the additional noise is a small sacrifice for the more parsimonious treatment of the effect of trust.

The approach that is adopted here is the following: productivity differences *between* countries should be matched by differences in interpersonal trust. The following hypothesis is suggested to test this relationship:

Hypothesis 1 *Cross-sectionally, high-trust countries are more productive (relative to the technological frontier) than low-trust countries.*

Based on the theoretical framework, a similar case can be made for the specific mechanism through which productivity is improved (i.e. when measured over a period of time *within* countries). Therefore, a similar approach is proposed: trust simply improves productivity; the exact mechanisms may diverge between (and perhaps also within) countries:

$$\Delta \text{Trust} \rightarrow \Delta \text{Total Factor Productivity (TFP)}.$$

To test this relationship, the following hypothesis is adopted:

Hypothesis 2 *Longitudinally, an increase in trust for country j increases its over-all level of productivity.*

4.3 Empirical strategy

Starting with the Penn World Table Version 8.0, the TFP levels for each country are directly available from the database. Because TFP levels are sensitive to the method of calculation (for instance with respect to the depreciation rate of capital), levels for similar units of observation (country,year) from previous studies often fluctuate. This new approach by the database maintainers allows to directly compare the results of future studies on the

determinants of differences in *TFP*. In light of the diverging conclusions and results related to the economic effect of trust, as well as for studies dealing with alternative theories on economic growth (Durlauf et al., 2008; Eberhardt and Teal, 2011), these supplied values aid in uniformly testing competing theories on growth and productivity. Therefore, the database values are used verbatim. For the sake of completeness a short description of the calculations is posted here. I note that these largely follow the operationalizations and derivations as proposed by the database maintainers, Feenstra et al. (2013).

Following Solow (1957) capital and labor are chosen as input for producing the national (aggregate) economic output, gross domestic product:

$$Y = A f(K, L). \quad (4.1)$$

Here, A denotes the productivity shift parameter: the multiplicative shift of output at given levels of capital and labor, output per unit input, or total factor productivity (*TFP*). The shift parameter A can be measured by taking the logarithmic differential of (4.1), which allows to factor the growth rate of output into the growth rates of capital and labor, weighted by their output elasticity, and the growth rate of A . By rewriting equation (4.1) an empirical estimation is feasible:

$$Y = AK^\alpha (E hc)^{1-\alpha}, \quad (4.2)$$

where E denotes the number of employed individuals, hc their level of human capital, α the output elasticity of capital, and finally $1 - \alpha$ the output elasticity of labor (effectively assuming constant returns to scale). Again following Solow, α is measured as the share of gross domestic product that is not earned by labor.

Productivity between countries (H1)

Productivity cannot be meaningfully measured unless its value is compared to 'competing' values (by comparing productivity across i and j countries, for instance), or previous values (across a time dimension t). To accomplish the former, equation (4.2) can be written as a Törnqvist quantity index of factor inputs Q :

$$\log Q_{ij} = 0.5(\alpha_i + \alpha_j) \ln \frac{K_i}{K_j} + \left(1 - 0.5(\alpha_i + \alpha_j)\right) \ln \frac{L_i}{L_j}. \quad (4.3)$$

By dividing each country's real gross domestic product (PPP adjusted) by Q_{ij} a cross-sectionally informative measure for the total factor productivity A , TFP_{ij}^C , can be obtained as follows:

$$TFP_{ij}^C = \frac{Real\ GDP_i / Real\ GDP_j}{Q_{ij}^T}. \quad (4.4)$$

Productivity is usually expressed relative to the productivity in the country at the technological frontier (Caselli and Coleman II, 2006). In line with previous research, the

United States of America is used as reference country to express total factor productivity, or $TFP_{US,j}^C$ (equal to 1, values above 1 indicate that productivity levels are above those at the technological frontier). I postulate that trust enters the production function through $TFP_{US,j}^C$, that is, trust shifts the productivity of labor and capital. To examine the importance of differences in productivity due to differences in trust the following regression is estimated:

$$TFP_{US,j}^C = \beta_0 + \beta_1 \text{trust}_j + \epsilon_j, \quad (4.5)$$

with $j \neq US$.

Productivity within countries (H2)

To measure changes in A within a country the cross-sectional Törnqvist quantity index from equation (4.3) can be rewritten as follows:

$$\log Q_{t,t-1}^T = 0.5(\alpha_t + \alpha_{t-1}) \ln \frac{K_t}{K_{t-1}} + (1 - 0.5(\alpha_t + \alpha_{t-1})) \ln \frac{L_t}{L_{t-1}}. \quad (4.6)$$

From the latter equation the growth of the productivity shift parameter A , TFP_j^T , can be derived as follows:

$$TFP_j^T = \frac{\text{Real GDP}_t / \text{Real GDP}_{t-1}}{Q_{t,t-1}^T}, \quad (4.7)$$

where *Real GDP* is measured at constant national prices.

I postulate that an increase in trust within a country j positively affects the productivity of labor and capital. As a result, an increasing trust level will increase the level of TFP_j^T . The following first-differenced regression equation is proposed to test the second hypothesis:

$$(TFP_{j,t}^T - TFP_{j,t-1}^T) = \beta_0 + \beta_1 (\text{trust}_{j,t} - \text{trust}_{j,t-1}) + \epsilon_j. \quad (4.8)$$

Endogeneity

Concerns of endogeneity are often expressed when relating economic outcomes and interpersonal trust (Bjørnskov, 2006). In particular, reverse causality may bias the estimated coefficients. For instance, growth of *Real GDP* may feed back into higher living standards, thereby affecting a society's trust disposition. To remedy this bias a number of variables are used as instruments. To allow for an unbiased estimation of both equations a number of instrument properties should be satisfied. First, the instruments should have a high correlation with the potentially endogenous variable. Additionally, the interpretation of the correlation should be meaningful. Second, the instruments should not correlate with ϵ_j .

There is a large number of instruments that satisfy the correlation argument. For instance, egalitarian societies have higher levels of trust (Bjørnskov, 2006). It is suggested that societies which are more equal in terms of the distribution of individual incomes

experience less social problems related to differences in languages spoken, race or culture (Bjørnskov, 2008b). Also, societies with a large share of religions that promote moral values that emphasize individual happiness and the importance of one's working life, such as Protestantism, score high on interpersonal trust (Welch et al., 2007).

Although these could serve as potential instruments in the current analysis, it is difficult to find instruments that do not relate to a country's productivity. For instance, Piketty (2014) shows that income inequality, a strong indicator for differences in trust, has mainly increased due to the productivity and profitability of capital. This yields the exogeneity of an instrument such as the Gini-coefficient questionable. Furthermore, productivity differences may be directly explained by Protestantism, which emphasizes thrift and hard work. Even more exogenously determined variables that explain differences in levels of trust, such as climate or the distance to the equator, have been related to productivity differences (Engerman and Sokoloff, 1997).

A number of instruments do however remain. Bjørnskov (2006) finds that countries with a Monarch at the head of the government have higher levels of trust, *ceteris paribus*. He argues that a king or queen acts as a symbol of a country's unity, and provides political and social stability. Furthermore, members of the royal family are expected to be societal role models. Kings and queens often publicly dismiss acts of misconduct among members of the population.³ Furthermore, it is unlikely that a monarchy affects productivity. Most monarchies have been in existence for many hundreds of years. Additionally, for many countries the position of monarch is hereditary. This rules out the possibility that the position of king or queen is endogenously chosen to increase a country's wealth or productivity.⁴

Second, Ahn and Esarey (2008) suggest that trust in a society can develop "*if reliable credentials allow people to distinguish between trustworthy and untrustworthy partners*" (p. 151). However, how does one differentiate between these two types? One possibility is to learn-by-doing: individuals interact with each other, which will sometimes result in a positive outcome, and sometimes not.⁵ The continuous interactions provide each individual with learning experiences, from which they may infer the correct amount of trust to hold vis-à-vis strangers. Alternatively, individuals can (passively) seek information about the trustworthiness of others. For instance, newspapers provide information on 'the way of the world' through the coverage of scandals (untrustworthy individuals) or through information provided by whistle blowers (trustworthy individuals). If the share of newspaper-reading individuals in society is large, then the potential for scrutinizing individual actions or social relations is similarly large.⁶ This may inhibit individuals from acting in a way that

³Bjørnskov mentions the Christmas and New Year's speeches that members of the royal families often present on televised broadcasts. These potentially serve as a check-and-balance for the public.

⁴This especially holds for the period of analysis of this study, as many countries have now switched to fully democratic political systems whereby the king or queen merely serves a minor (or even ceremonial) political role.

⁵Relating to Butler et al. (2012): sometimes the taxi driver will take a scenic route, sometimes he will drive directly from A to B.

⁶Some Italian colleagues have pointed out to me that they question this instrument, because they themselves do not take newspaper writings seriously in Italy (mostly because journalists express substantial bias in their writings). However, I would argue that the fact that the newspaper cannot be trusted (and is thus not read) is exactly why the instrument functions correctly (and why levels of interpersonal trust are relatively low for Italy).

is publicly frowned upon. Additionally, newspapers are readily available in most of the world's countries (although the quality of newspapers may diverge, in particular under more oppressive governmental regimes). Finally, the first newspaper dates back to Ancient Rome, making them a relatively common factor (although the information contained in them may certainly provide a shock). Therefore, newspapers are unlikely to endogenously determine current productivity levels.

The following first-stage regression results:

$$trust_j = \beta_0 + \beta_1 Monarchy_j + \beta_2 Newspapers_j + \eta_j. \quad (4.9)$$

I note that the instruments from the previous equation are perhaps ill-suited to serve as instrument for the growth of trust (Equation 4.8). Unfortunately, to date there exists no macro-oriented research that deals with the (potential) mechanisms behind this growth. I will attempt to re-use the instrument $Newspapers_j$, which due to the nature of the regression equation now is an average value for $T = 1$ and $T = 2$. A country that is better informed about the trustworthiness of the population will most likely also have the highest probability of having within-country growth of trust.

$$(trust_{j,t} - trust_{j,t-1}) = \beta_0 + \beta_1 Newspapers_j + \eta_j. \quad (4.10)$$

4.4 Data

This section shortly describes the data (and sources) that were used in this study. A preliminary note on the construction of the data is warranted. Due to unequal survey cycles for the World Values Survey (WVS), from which the interpersonal trust variable was derived, the observations for interpersonal trust are not consistently observed for each country-wave combination. In total, five WVS waves are available: 1 (1984-1989), 2 (1990-1994), 3(1995-1999), 4 (2000-2004) and 5 (2005-2008). A traditional panel analysis using the wave as time unit would yield an extremely unbalanced panel.⁷ Therefore the following approach was used to construct the data set.

The first wave (which ran between 1984-1989) of the WVS contains only a handful of countries and was therefore left out. The second to fifth wave contains 85 unique countries. Combined with the data on productivity (which does not hold productivity data on all countries), this leaves a total of 65 unique countries. Splitting this sample down the middle, with wave 2-3 (1990-1999) as $T = 1$ and wave 4-5 (2000-2008) as $T = 2$, yields the largest sample to estimate the longitudinal regression equation. Furthermore, this results in two periods of approximately equal length (in years). If two countries appeared in both waves for each of the original periods (for instance, a country appeared in wave 2 and 3) the average value for interpersonal trust was calculated (in this example, this would result in $\frac{trust_{wave1} + trust_{wave2}}{2}$). For $T = 1$ this yields 41 countries, for $T = 2$ 55 countries are available. In total, 33 countries appear in both newly constructed periods ($T = 1$ and $T = 2$).

⁷Not regarding the first wave (where only a handful of countries participated), only 11% of the countries in the sample appear in all waves (2-4). This number drops to 3% for countries that appear in 2 out of the 3 waves.

Total factor productivity

Both the cross-sectional measure of TFP ($TFP_{US,j}^C$), as well as the within-country measure (TFP_j^T) were derived from the Penn World Table 8.0.⁸ Total investments, corrected for depreciation and historical capital stocks, were used to measure capital. To measure labor input, the total number of persons engaged in the production of economic goods and services (E) was used, as well as an index for human capital (hc) based on the returns to schooling from Psacharopoulos (1994) and average years of schooling from Barro and Lee (2013). An in depth description of the sources and calculations for these variables is provided by Inklaar and Timmer (2013). For TFP_j^T , real GDP is expressed in 2005 prices.

Similar to the approach explained above, the values for the TFP are mean-averaged, with the TFP level for $T = 1$ being the average between 1990-1999, and for $T = 2$ the average between 2000-2008. Note that the development of productivity within and between countries may exhibit a trend. This may be due to the fact that aggregate output Y , used to calculate TFP , contains a trend. Alternatively, a positive trend in TFP may simply occur because countries become more efficient in producing a similar output level Y over time. Therefore, $TFP_{US,j}^C$ and TFP_j^T were linearly detrended. I follow the approach as described by Wooldridge (2013, chapter 10). For $TFP_{US,j}^C$, the following regression was first estimated:

$$TFP_{US,j}^C = \beta_0 + year_t + \varepsilon_j,$$

with $year_t$, a dummy for each year between 1990 and 2008. The detrended productivity metric is equal to ε_j from this equation. To match the data on interpersonal trust, the average value for ε_j was calculated for $T = 1$ and $T = 2$. The result is the variable $TFP_{US,j}^C$ (*detrended*) for $T = 1$ and $T = 2$.

Similarly, for TFP_j^T the following regression was first estimated:

$$TFP_{j,t}^T = \beta_j + year_t + \varepsilon_{jt},$$

with β_j , a dummy for each country (0, 1) and $year_t$, a dummy for each year (0, 1) between 1990 and 2008. The detrended productivity metric is equal to ε_{jt} from this equation. To measure the within growth of productivity, the average value for ε_{jt} for $T = 2$ was subtracted from the average value from $T = 1$. The result is the variable TFP_i^T (*growth, detrended*).

⁸See Feenstra et al. (2013) or <http://www.ggdnet/pwt>

Interpersonal trust

Interpersonal trust was obtained from the the World Values Survey (WVS). The WVS presents individuals with the question: "*Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?*". Respondents are asked to rate the extent to which they agree with the statement on a 2 point scale (where 0 indicates that "You cannot be too careful", and 1 indicates that "Most people can be trusted"). The share of people answering 1 is recorded for each country. To confirm this variable's validity, I note that the survey statement has previously been shown to relate to outcomes from trust-game experiments (Glaeser et al., 2000; Naef and Schupp, 2009; Sapienza et al., 2013).

Instrumental variables

Wahman et al. (2013) provide an extensive data set on regime types. There are currently 44 countries in the world with a monarch at the head of the government. For $T = 1$, 7 out of these 44 are present ($T = 2$, 14 are present). A dummy variable is created, whereby each monarchy is coded with a 1. Furthermore, the total average circulation (copies printed) of daily newspapers per 1,000 individuals is recorded from the UNdata tables.⁹ Daily newspapers are those published four times a week (or more frequently).

Summary statistics for Hypothesis 1 are printed in Table 4.1. Although the variable $TFP_{US,j}^C$ (*detrended*) is used in the econometric analysis, the non-detrended mean of the variable $TFP_{US,j}^C$ is provided for the sake of comparison. Notice the large drop in observations for the instrument *Newspapers* compared to the total number of observations for the productivity metric. I will address this issue when testing Hypothesis 1. A correlation matrix is posted in Appendix 4.A. I note that in general the correlations between all the variables for Hypothesis 1 are relatively large, but not worryingly large (values around .60 and below). Summary statistics for Hypothesis 2 are printed in Table 4.2.

⁹<http://data.un.org>

Statistic	Period 1: 1990-99					Period 2: 2000-08				
	N	Mean	St. Dev.	Min	Max	N	Mean	St. Dev.	Min	Max
Original productivity variable $TFP_{US,j}^C$	41	0.63	0.22	0.20	1.04	55	0.66	0.27	0.18	1.27
Detrended productivity variable $TFP_{US,j}^C (detrended)$	41	-0.02	0.22	-0.45	0.39	55	-0.04	0.27	-0.49	0.60
Independent variable <i>Interpersonal trust (%)</i>	41	0.27	0.14	0.05	0.65	55	0.27	0.17	0.04	0.74
Instrumental variables <i>Monarchy</i>	41	0.17	0.38	0	1	55	0.25	0.44	0	1
<i>Newspapers</i>	39	1.85	1.571	0.18	5.86	36	1.73	1.56	0.01	5.58

Table 4.1: Descriptive statistics for Hypothesis 1. Sample contains two periods: $T = 1$ (1990-1999) and $T = 2$ (2000-2008). The variable $TFP_{US,j}^C$ is the average productivity for period $T = 1$ and $T = 2$, measured relative to the United States. It is derived directly from the Penn World Tables. $TFP_{US,j}^C (detrended)$ is the linearly detrended average productivity for period $T = 1$ and $T = 2$. *Interpersonal trust (%)* is the percentage of high-trust individuals per country. The variable *Monarchy* is coded as a dummy variable (1=country is a monarchy). *Newspapers* is measured as the average number of daily newspapers in circulation (per million inhabitants) for $T = 1$ and $T = 2$.

Statistic	N	Mean	St. Dev.	Min	Max
Original productivity variable					
TFP_i^T (growth)	33	0.05	0.09	-0.09	0.25
Detrended productivity variable					
TFP_i^T (growth, detrended)	33	-0.01	0.09	-0.15	0.20
Control variables					
<i>Interpersonal trust</i> (% growth)	33	0.01	0.06	-0.14	0.14
Instrumental variables					
<i>Newspapers</i> (avg.)	31	2.03	1.60	0.28	5.86

Table 4.2: Descriptive statistics for Hypothesis 2. Sample contains two periods: $T = 1$ (1990-1999) and $T = 2$ (2000-2008). TFP_i^T (growth) measures the within-country growth of productivity. It is derived directly from the Penn World Tables. TFP_i^T (growth, detrended) measures the linearly detrended within-country growth of productivity ($T = 1 \rightarrow T = 2$, detrended). *Interpersonal trust* (% growth) measures the percentage change in high-trust individuals per country ($T = 1 \rightarrow T = 2$). *Interpersonal trust* (avg.) is the sample average share of high-trust individuals per country (average $T = 1, 2$). The variable *Monarchy* is coded as a dummy variable (1=country is a monarchy). The variable *Newspapers* is measured as the average ($T = 1, 2$) number of daily newspapers in circulation (per million inhabitants).

4.5 Results

4.5.1 Productivity between countries (H1)

The first hypothesis deals with differences in productivity (relative to the United States) due to differences in trust between countries. Figure 4.2 on page 85 visualizes this relationship for both periods. In general, the hypothesized relationship between both variables is found: higher levels of trust are associated with higher levels of productivity. However, there are some outliers with respect to productivity (for instance, Armenia) and trust (for instance, China).

With respect to outliers in terms of productivity: this problem is similar to the investigation of the growth of GDP between countries (Eberhardt and Teal, 2011). In this sense, the cross-sectional analysis of productivity (instead of, for instance, the growth of GDP) does not *entirely* eliminate the possibility of finding 'mixed results' on the economic significance of trust. I will address this issue in the Discussions section. With respect to outliers in the variable *Interpersonal trust* (%), China has a remarkably high trust level. Furthermore,

the productivity effect of this high trust level is absent, rendering it an outlier in both plots. This is in line with Berggren et al. (2008), who similarly find China to be an outlier in their analysis of trust and GDP growth. Steinhardt (2012) argues that this high trust level is probably the result of a high level of confidence in the government, which through its economic growth plans has improved the economic position of many of the country's individuals.

OLS and 2SLS results of Equation 4.5 are provided in Table 4.3 on the following page. Note that for each period two OLS models are estimated: the first uses the complete sample of available observations, whereas the second uses the sample available for the estimation of the 2SLS regressions. Heteroskedasticity robust standard errors are reported for all models. First-stage regression results for the 2SLS results are posted in Appendix 4.C. The results confirm the positive relationship between trust and productivity. The effect is large: a 10% increase in the number of high-trust individuals in a country's population increases $TFP_{US,j}^C$ by .45 to 1.56 (depending on the OLS or 2SLS estimate). The large variation in productivity between countries is reflected in the modest R^2 values. However, studies relating trust to growth often report R^2 values below 20% (see for instance Knack and Keefer, 1997).

The differences between the OLS and 2SLS estimates are relatively large, however. The results suggests that the OLS estimate is downward biased. Baltagi (2008, p. 139) suggests that this occurs when the relationship is strongly endogenous (i.e. the correlation between the model's error and the endogenous variable is high), or when the sample size is relatively small (causing the 2SLS estimator itself to be biased; a solution would be to extend the number of observations). Here, I do not expect the 2SLS to be biased. First, the upward bias is observed for both sample periods. Furthermore, the first-stage regressions (Appendix 4.C) show that a weak instrument bias is not expected (measured with the Kleibergen-Paap statistic (Kleibergen and Paap, 2006), and furthermore judging by the value for the first-stage F-statistic (>10) (Stock and Yogo, 2005)). As a final robustness check, Appendix 4.D provides estimations for the second hypothesis using the Limited information Maximum Likelihood Instrumental variables estimation technique (LIML IV) as proposed by Anderson and Rubin (1949) (also see Staiger and Stock, 1997). Baltagi (2008, p. 139) suggests that the LIML IV is more appropriate for finding the correct population parameter for instrumental variables estimations with small sample sizes. The coefficient estimates for this estimator are however similar to those from Table 4.3.

Based on these results I do not reject H1: high-trust countries are more productive (relative to the technological frontier) than low-trust countries.

	Period 1: 1990-99			Period 2: 2000-08		
	<i>OLS</i>	<i>OLS</i>	<i>2SLS</i>	<i>OLS</i>	<i>OLS</i>	<i>2SLS</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Intepersonal trust (%)	0.51** (0.23)	0.45* (0.23)	1.36*** (0.40)	0.66*** (0.22)	0.78*** (0.25)	1.53*** (0.29)
Constant	-0.16** (0.07)	-0.15** (0.07)	-0.40*** (0.13)	-0.18** (0.07)	-0.19** (0.09)	-0.41*** (0.10)
Observations	41	39	39	55	36	36
R ²	0.10	0.09		0.16	0.24	
F Statistic	4.69** (df = 1; 39)	3.78* (df = 1; 32)		8.86*** (df = 1; 53)	10.0*** (df = 1; 34)	
Sargan (p)			0.86			0.76

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4.3: OLS and 2SLS models for Hypothesis 1. Dependent variable: $TFP_{US,j}^C$. Instruments for *Interpersonal Trust*, 2SLS: *Monarchy* and *Newspapers*. Sargan test for overidentifying restrictions is printed at the bottom (H0: instruments are valid). Heteroskedasticity robust standard errors in parentheses. Within-sample change of N due to instrument availability.

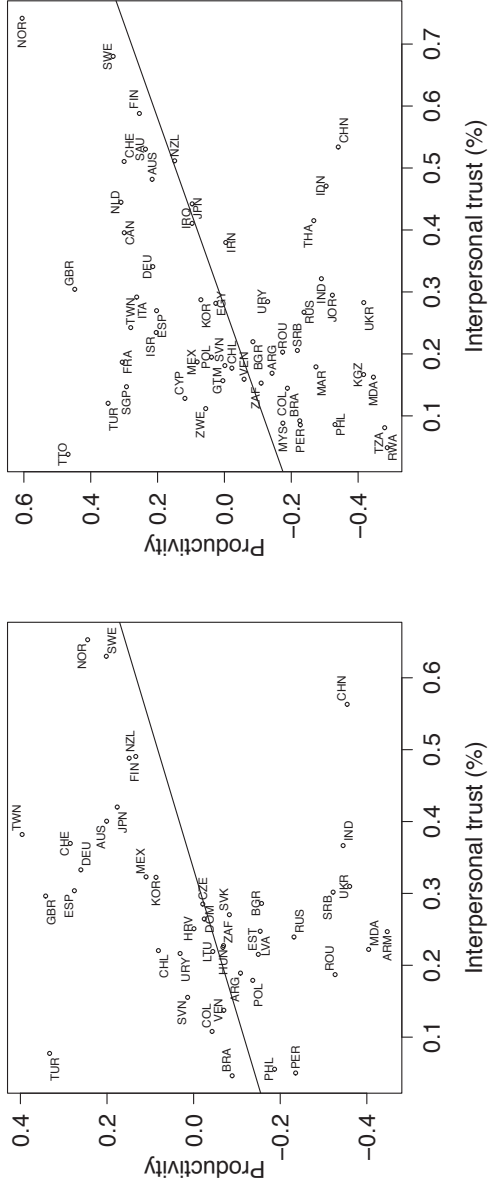


Figure 4.2: Linear relationship between productivity $TFP_{US,j}^C$ (*detranded*) and the share of high-trust individuals per country, *Interpersonal trust (%)*. Both periods clearly show an upward sloping relationship: larger trust values are associated with higher productivity values (relative to the United States). In both periods, the relationship is less distinct for low-trust, low-productivity countries. This could indicate that the economic significance of trust is dependent upon the level of economic development of a country. For instance, the effect may be non-existent for developing countries such as Ukraine or India. In terms of trust, China is a relative outlier in both samples. This is in line with previous studies relating trust to other economic variables, such as GDP growth. The finding adds to the doubts in the literature on the understanding of trust-related survey questions in China.

4.5.2 Productivity within countries (H2)

The second hypothesis deals with the within-country improvement of productivity due to the growth of interpersonal trust (between the first period, 1990-1999, and the second period, 2000-2008). OLS and 2SLS estimations are provided. Because of the relatively small sample of observations, which further increases the potential for outlier-observations (as compared to Hypothesis 1), a robust regression (R.R.) approach is included. Estimations are performed using the R package 'robustbase' (Rousseeuw et al., 2014), using the small sample estimator as proposed by Koller and Stahel (2011) (an extension to the MM-estimator). The reported heteroskedasticity-robust standard errors for these regressions are those proposed by Croux et al. (2003). Finally, first-stage regression results for the 2SLS results are posted in Appendix 4.C.

Table 4.4 on page 88 provides the estimation results for Hypothesis 2. Figure 4.3 on page 89 visualizes this relationship. Although a similarly positive association between trust and productivity is found, the effect is not significant for the full sample of countries. Only when the sample is restricted to include countries where the productivity grew by less than 0.15 does the effect of trust become significant. A closer inspection reveals that the three countries that are no longer in this sub-sample, China, Poland and Romania, are former underdeveloped nations that recently started to develop rapidly. From 1990 onwards, China has seen dramatic increases in economic growth and productivity. Furthermore, after the collapse of the Communist regime Poland consistently reached high economic growth rates (above 3%) and is now the sixth largest economy of Europe. Romania has attracted large amounts of foreign direct investments since the middle of the 1990's (in this respect, it is one of the most successful countries of South-East Europe (Hunya, 2002; Estrin and Uvalic, 2014). Therefore, the growth in productivity of these countries is most likely a reflection of the improvement of the relatively unproductive economic environments of the past.

This is confirmed when a sub-sample of OECD countries is considered. OECD membership is usually granted to a country if it has shown to commit to the development of a free market economy and a democratic political system. Relatively underdeveloped nations are therefore not considered eligible for membership. It has previously been suggested that both a free market economy and a democratic political system are necessary conditions to develop interpersonal trust (Fukuyama, 1992).¹⁰ Once these are in place, the economic effect of trust may manifest itself (Fukuyama, 1995).

In terms of the magnitude of the coefficients, the effect of the growth of trust on the growth of productivity is considerable. If the percentage of high-trust individuals in a country increases by 10%, productivity on average increases with 0.06 (in terms of TFP_j). Unfortunately, the used instrument proved to be insufficient to correct for a potential

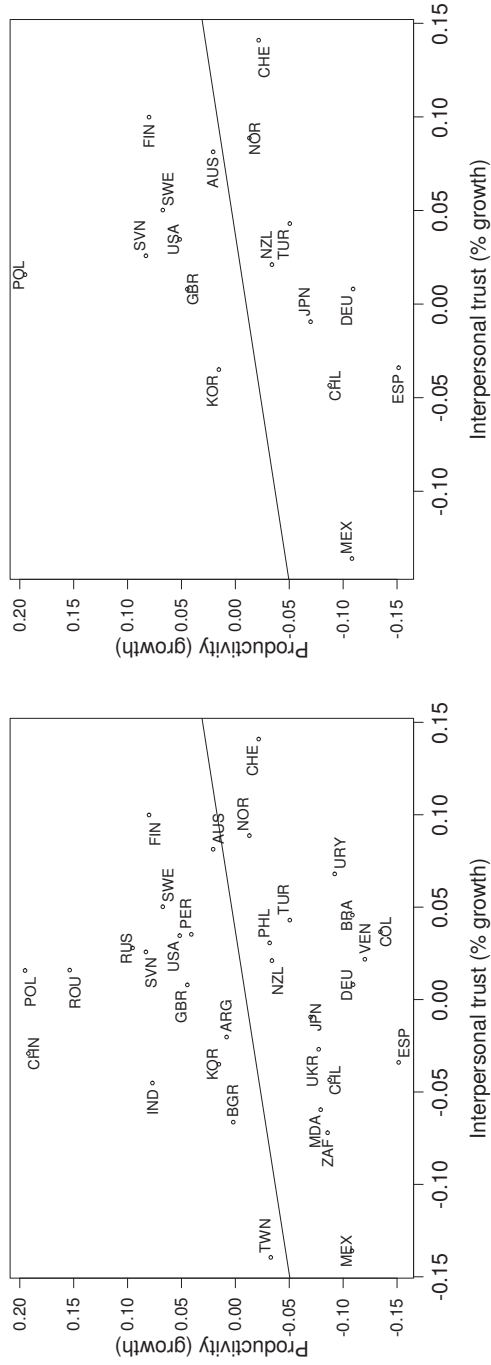
¹⁰For instance, Fukuyama (1992) argues that without these conditions individuals would never build the interpersonal networks necessary to develop large organizations, expand businesses and build strong institutions through collective action. Instead, they would remain locked in tightly-knit, inwardly-focused communities. The classic example of this is the large differences in family-networks between the Northern and Southern part of Italy. The strong bonds exemplary for families in the South have negatively affected the quality of the regional governments (for example, through the proliferation of the Mafia), whereas the open family networks of the North promoted interpersonal interactions which increased the region's quality of governance (Putnam et al., 1994).

endogenous relationship. Although the correlation between the growth of trust and the average number of daily newspapers in circulation is relatively high (0.44), the instrument fails to pass some measures of instrument quality, such as the first-stage F-statistic (>10) (Stock and Yogo, 2005). Similar to the first hypothesis, the instrumental variables model was estimated through LIML (Appendix 4.D). The results remained similar. I suspect that the instrument alone is not powerful enough to explain the growth of trust between the two periods (although the positive effect of trust remains). In this sense, it serves its purpose well in explaining the cross-sectional differences in trust, but not the differences in the growth of trust. Furthermore, the growth of trust is relatively small: the Summary statistics table (4.2) shows that the average growth in the sample was only 1%. It is difficult to find an instrument that is accurate in explaining this small amount of variation, and which itself does not add additional noise. Longer time-series will (hopefully) resolve this issue.

Based on these results I do not reject H2: an increase in trust for country j increases its over-all level of productivity. I do note, however, that the potential endogenous relationship between both variables has not been convincingly addressed for H2.

	Complete sample			growth <0.15			OECD		
	OLS	R.R.	2SLS	OLS	R.R.	2SLS	OLS	R.R.	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Interpersonal trust (% growth)	0.27 (0.19)	0.29* (0.17)	0.02 (0.62)	0.30* (0.17)	0.30* (0.15)	0.62 (0.55)	0.57*** (0.27)	0.57*** (0.21)	0.29 (0.77)
Constant	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03* (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.03)
Observations	33	33	31	30	30	28	17	17	17
R ²	0.03	0.04		0.07	0.06		0.18	0.18	
F Statistic	1.03 (df = 1; 31)			2.48 (df = 1; 28)			3.18* (df = 1; 15)		
Note:	* p<0.1; ** p<0.05; *** p<0.01								

Table 4.4: OLS, R.R. and 2SLS models for Hypothesis 2. Dependent variable: $(TFP_{j,t}^T - TFP_{j,t-1}^T)$. Instrument: $Newspapers(avg.)$. Heteroskedasticity robust standard errors in parentheses. Within-sample change of N due to instrument availability.



(4.3a) Complete sample. $N = 34$

(4.3b) OECD $N = 17$

Figure 4.3: Linear relationship between productivity growth ($TFP_{j,t}^T - TFP_{j,t-1}^T(detrended)$) and the growth in the share of high-trust individuals per country, *Interpersonal trust (% growth)*. Both samples show an upward sloping relationship: increasing trust values are associated with within-country productivity growth. The relationship is only significant if countries with productivity growths less than 0.15, and the OECD sample. Similar to the results from Hypothesis 1, this could indicate that the economic significance of trust is dependent upon the level of economic development of a country. For instance, large productivity gains (>0.15 in this sample) may not be due to a growth in trust, but due to the transformation of previously unproductive (socialist) economies.

4.5.3 Discussion

The general conclusion of the current study is that trust is positively related to productivity. This suggests that the main difference of this study over previous studies, analyzing the economic significance of trust in a framework that unifies the concept's theoretical mechanisms, yields the expected results (from an empirical perspective). Although the results presented are quite general, they offer a first step in building new theories on more specific macroeconomic effects of trust. Furthermore, analyzing between and within-country levels of *TFP* from the Penn World Table, which now hold 'standardized' values for productivity, opens up the opportunity of delving into the country-specific effects of trust (for instance, by investigating if the effect on labor or capital is homogenous across countries)

Although not the study's main motivation, the finding that the effect of trust is more pronounced for (relatively) developed countries for both the cross-sectional and longitudinal sample is somewhat striking. It suggests that the economic effect of trust is dependent upon a country's level of development. I deliberately use the broad term 'development' here, as this may be expressed in various ways. For example, a positive effect of trust on productivity may be dependent upon (relative) living standards, life expectancy, political rights, emancipation, or the institutional framework (quality of education, government). Alternatively, it may suggest that the effect of trust is not *universally* linear in terms of labor and capital. For instance, countries at the bottom of the *TFP* parameter have economies where labor is relatively inexpensive (as opposed to capital). Manual labor, therefore, is more abundantly used for the aggregate production *Y*. The productivity of labor, *ceteris paribus*, is however largely dependent upon the ability of a population to grow (the standard Malthusian argument for the growth of *Y*). Intuitively, large changes in productivity will likely not be the result of high levels of trust (or a growth thereof) for such countries. Contrarily, increases in capital, such as through machinery that allows for the mechanization of manual labor, *will* dramatically increase productivity.¹¹ The results from Hypothesis 2 corroborate this explanation: when a subset of developed countries is considered, the relationship between trust and productivity is confirmed, and *is* relatively linear for the complete sample. Unfortunately, it is difficult to disentangle when productivity improvements are solely because of macroeconomic policies, or when they are the outcome of societal processes that shape the ways in which individuals interact (Durlauf et al., 2008). Similarly, this finding may also point at the reason for the large share of mixed results of Barro-type growth regressions.¹²

¹¹ Although one could argue that a higher trust level can provide access to financial capital, which can increase the usage of capital in an economy, and similarly improve productivity.

¹² Some progress on this matter has recently been made. For instance, similar to the presented results in this paper, Peiró-Palomino and Tortosa-Ausina (2013) show that the effect of trust on the level of GDP per capita is not uniform across economies. Using quantile regressions, the authors report that the effect is not found for relatively poor economies.

4.5.4 Limitations

An important limitation of the current study is the small sample for which data on interpersonal trust is available. For some, this may cast doubt on the significance of the estimates. I report that a power analysis reveals that this problem is not expected for the estimations of hypothesis 1: all estimations have a probability of 80% (or higher) of correctly rejecting the null hypothesis when the null hypothesis is false (i.e. the ability of the regression to detect an effect of trust on productivity, when the effect exists). However, the regressions from the second hypothesis do indeed suffer from their small N : the power drops to 40-55% here, depending on the chosen confidence level. Although this does not invalidate the reported results, I would like to point out that the longitudinal results should be read with some caution.

Furthermore, relatively little is known about the longitudinal development of trust. This study's analysis shows that trust levels clearly deviate between periods. However, its economic effect is not uniform across countries, which suggests that it may be bounded by certain development thresholds. In this respect, the research agenda as proposed by Woolcock and Narayan (2000), which focuses on the interplay between various sources and mediators of social capital and trust on the one hand, and economic development on the other hand, may prove insightful for future studies.

4.6 Conclusion

Empirical studies using Barro-type growth regressions have often resulted in contradictory findings concerning the economic significance of interpersonal trust. These regressions, however, do not take into account auxiliary economic improvements (for instance, reductions in total hours worked without sacrificing aggregate output) and instead focus solely on economic growth (for instance, GDP growth). A large volume of research shows that trust may affect the productivity of labor as well as the productivity of capital. For instance, trust reduces principal-agent problems related to asymmetric information. Furthermore, it facilitates access to the embedded resources (capital) in networks of agents. Similarly, high-trust countries often have better institutional environments, which may affect the productivity of capital and labor through reducing rent-seeking or improving property rights policies. This study suggests that for these reasons, overall productivity improvements are a better candidate to quantify the economic effects of trust.

Using a standard Solow growth model framework and the share of high-trust individuals per country from both a cross-sectional and longitudinal panel from the World Values Survey (1990-2008), I test if trust significantly affects productivity. Longitudinally, the results show that an increase in trust is positively related to the growth of productivity in the last two decades. Two instruments are used to mitigate endogeneity problems. The first measures if the country has a monarch at the head of the state, the second measures the number of daily newspapers in circulation per country. It is argued that both affect the trust level by providing information on the trustworthiness of strangers through public scrutiny. For

instance, many kings and queens address socially unwanted behaviors publicly through New Year's speeches. Similarly, newspapers provide information on socially unwanted behavior of fellow members of society such as scandals, crimes and other misconducts. Cross-sectionally, I find that high-trust countries on average have higher levels of productivity. Longitudinally, I similarly find that an increase in the percentage of high-trust individuals per country positively influences productivity, but only significantly so for countries where productivity grew (i) modestly (up to a growth of 0.15 in *TFP*), and (ii) relatively advanced economies (OECD member countries). This finding implies that the economic effect of trust is dependent upon certain a priori development conditions within countries. Potentially, these are related to the development of interpersonal trust, such as through a free market economy and a democratic political system. Therefore, this may explain why empirical analysis using growth often find contradictory results in terms of its significance: the economic effect of trust is simply not universal.

Acknowledgements

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Appendix 4.A Correlation matrix

Productivity between countries (H1)

Note that the following table is based on $N = 75$, which is the total number of observations available for both sample periods, $TFP_{US,j}^C$ (*detrended*), *Interpersonal trust* (%) and both instruments. The correlation between $TFP_{US,j}^C$ (*detrended*), *Interpersonal trust* (%) for the OLS sample (excluding instruments), $N = 96$, is 0.37.

	$TFP_{US,j}^C$ (<i>detrended</i>)	Interpersonal trust (%)	Monarchy	Newspapers
$TFP_{US,j}^C$ (<i>detrended</i>)				
Interpersonal trust (%)	0.41			
Monarchy	0.48	0.52		
Newspapers	0.61	0.66	0.45	

Table 4.5: Correlation matrix for Hypothesis 1. $N = 70$.

Productivity within countries (H2)

	TFP_i^T (growth, detrended)	Interpersonal trust (% growth)	Monarchy	Newspapers (avg.)
TFP_i^T (growth, detrended)				
Interpersonal trust (% growth)	0.17			
Monarchy	-0.05	0.19		
Newspapers (avg.)	0.11	0.44	0.49	

Table 4.6: Correlation matrix for Hypothesis 2. Note: due to the inclusion of the variable *Newspapers*, the number of observations drops slightly from $N = 33$ to $N = 31$. This correlation matrix was calculated using $N = 31$. The difference between the correlation coefficients between the two samples is marginal.

Appendix 4.B Countries in sample

Productivity within countries (H2)

	Country code	Country name	OECD
1	ARG	Argentina	No
2	AUS	Australia	Yes
3	BGR	Bulgaria	No
4	BRA	Brazil	No
5	CHE	Switzerland	Yes
6	CHL	Chile	Yes
7	CHN	China	No
8	COL	Colombia	No
9	DEU	Germany	Yes
10	ESP	Spain	Yes
11	FIN	Finland	Yes
12	GBR	United Kingdom	Yes
13	IND	India	No
14	JPN	Japan	Yes
15	KOR	Korea, South	Yes
16	MDA	Moldova	No
17	MEX	Mexico	Yes
18	NOR	Norway	Yes
19	NZL	New Zealand	Yes
20	PER	Peru	No
21	PHL	Philippines	No
22	POL	Poland	Yes
23	ROU	Romania	No
24	RUS	Russia	No
25	SVN	Slovenia	Yes
26	SWE	Sweden	Yes
27	TUR	Turkey	Yes
28	TWN	Taiwan	No
29	UKR	Ukraine	No
30	URY	Uruguay	No
31	USA	United States	Yes
32	VEN	Venezuela	No
33	ZAF	South Africa	No

Table 4.7: Countries available for Hypothesis 2.

Appendix 4.C First-stage regressions

Productivity between countries (H1)

Table 4.8 provides the first-stage regressions for Hypothesis 1. Note that *Monarchy* is just over the 10% significance threshold in Period 2.

	Period 1: 1990-99	Period 2: 2000-08
	(1)	(2)
Monarchy	0.14** (0.05)	0.08 (0.05)
Newspapers	0.04*** (0.01)	0.07*** (0.01)
Constant	0.18*** (0.03)	0.13*** (0.03)
Observations	39	36
R ²	0.46	0.56
Adjusted R ²	0.43	0.53
F Statistic	15.12*** (df = 2; 36)	20.64*** (df = 2; 33)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4.8: First-stage regressions. Standard errors in parantheses.

Productivity within countries (H2)

Note: the OECD sample includes the following countries: Australia, Chile, Finland, Germany, Japan, Mexico, New Zealand, Norway, Poland, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

	Complete	OECD
	(1)	(2)
Newspapers (avg.)	0.02** (0.01)	0.02* (0.01)
Constant	-0.02 (0.01)	-0.03 (0.03)
Observations	31	17
R ²	0.18	0.21
Adjusted R ²	0.16	0.15
F Statistic	6.58** (df = 1; 29)	3.89* (df = 1; 15)
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 4.9: First-stage regressions. Standard errors in parantheses.

Appendix 4.D LIML IV estimation

Productivity between countries (H1)

	Period 1: 1990-99	Period 2: 2000-08
	(1)	(2)
Interpersonal trust (%)	1.36*** (0.39)	1.53*** (0.28)
Constant	-0.40*** (0.12)	-0.41*** (0.10)
Observations	39	36
Anderson-Rubin (p)	0.94	0.71

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.10: Limited information Maximum Likelihood Instrumental variables estimation for Hypothesis 1. Dependent variable: $TFP_{US,j}^C$ (detrended). The Anderson-Rubin test for overidentifying restrictions is printed at the bottom (H0: instruments are valid). Heteroskedasticity robust standard errors in parentheses.

Productivity within countries (H2)

	Complete sample	Prod. <0.15	OECD
	(1)	(2)	(3)
Intepersonal trust (% growth)	0.005 (0.13)	0.005 (0.13)	0.08 (0.20)
Constant	-0.01 (0.05)	-0.01 (0.05)	-0.03 (0.08)
Observations	31	31	17

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.11: Limited information Maximum Likelihood Instrumental variables estimation for Hypothesis 2. Dependent variable: $(TFP_{j,t}^T - TFP_{j,t-1}^T)$. Instrument: *Newspapers (avg.)*. Heteroskedasticity robust standard errors in parentheses.

"The relationship between man, the producer, and the social world, his product, is and remains a dialectical one. That is, man (not of course, in isolation but in his collectivities) and his social world interact with each other. The product acts back upon the producer."

Berger and Luckmann, *The social construction of Reality* (1966)

5

The relationship between technological capabilities and interpersonal trust

A cross-country empirical study

5.1 Introduction

Why do countries with high levels of interpersonal trust have higher levels of economic development? In his seminal contribution "*Trust: The Social Virtues and The Creation of Prosperity*", Fukuyama (1996) takes Coase's theory of the firm to provide a rationale for this observation. Because there are costs involved when obtaining information on the 'right price', negotiating separate contracts in the market becomes expensive and inefficient once an economic exchange becomes more complex (Coase, 1937). In particular, it is difficult to search the appropriate parts of the complete transaction and negotiate 'correct' prices for each of them (for instance, due to information asymmetries accruing from dishonesty or opportunism). Firms emerge because they allow the reduction of transaction costs. Extending this reasoning, Fukuyama argues that in countries where a high level of interpersonal trust is embedded in the culture, this transaction-cost-reducing mechanism works most efficiently. He defines this type of trust as the kind that emerges through 'spontaneous sociability': the trust that builds through loose relations with non-kin individuals. In this sense, the level of 'national' interpersonal trust is comparable to the amount of trust the average citizen places in a random stranger. Fukuyama further argues that trust lowers intra- and interfirm transaction costs, that it allows firms to

realize economies of scale, and that it helps facilitate the development of multinational activities. High-trust countries, therefore, are characterized by efficient and developed markets. In contrast, societies with low levels of trust have difficulty developing modern market economies. As a consequence, these are marked by high transaction costs and inefficient markets.

When relating trust to development, most researchers have relied on this 'transaction costs explanation' to investigate the effect of trust on macro-economic outcomes. Examples are the growth of the gross domestic product (GDP) (Knack and Keefer, 1997), financial development (Guiso et al., 2004), per capita income (Dearmon and Grier, 2009) or the growth of employment (Dincer and Uslaner, 2009). Recent reviews of the empirical literature show, however, that on the whole, the results of the economic significance of trust are mixed (Westlund and Adam, 2010). Although a positive effect is unanimously found, the effect does not always impact economic exchanges significantly; a finding which especially holds for macro-level studies.

This leaves us with two options. The first is to adopt the bleak outlook proposed by some that the concept of trust itself is not relevant for explaining economic outcomes. For instance, in his review of Fukuyama's book, Solow (1995) claims that the concept is too vague to be directly applied to economic theory, and suggests to integrate it with existing and ongoing transaction costs research such as Williamson's theory on incomplete contracts (1979; 1993). Some efforts have indeed been made in this direction. However, these studies typically focus on micro-economic settings. Furthermore, their conclusion often is that trust does matter, contrary to what Williamson (1993) argues (for a recent contribution see Herold, 2010). The second option is that the theoretical umbrella of transaction costs economics is too limiting to understand the role of trust in facilitating economic interaction, in particular when explaining macro-level differences. This study exercises the second option.

In this light, an increasing number of scholars have been reconceptualizing the theory of the firm as proposed by Coase (1937). Instead of a transaction cost minimizing entity, firms are increasingly understood as "*a social community specializing in the speed and efficiency in the creation and transfer of knowledge*" (Kogut and Zander, 1996, p. 503). This view focuses more on the superiority of firms to develop distinct capabilities (i.e. beyond what would be possible through market exchanges). Differences in performance between firms exist not because of differences in the ability to minimize transaction costs, but because firms differ in their 'absorptive capacity', or their "*...ability to recognize the value of new information, assimilate it, and apply it to commercial ends*" (Cohen and Levinthal, 1990, p.128). This difference in absorptive capacity exists because not all firms are equally capable of converting 'potential' knowledge, such as formal education of employees, to new products and services. Zahra and George (2002) claim that firms that are more efficient in this conversion process have a higher level of performance. Through what the authors refer to as 'social integration mechanisms', these firms are able to obtain superior absorptive capacities which allow for distinct competitive advantages (Nahapiet and Ghoshal, 1998; Todorova and Durisin, 2007). These mechanisms consist of informal social mechanisms that promote the

sharing of ideas, interpretations and trends (through knowledge sharing in informal social networks) and formal social relationships that improve understanding and comprehension (for instance, through R&D alliances). Once realized, absorptive capacity becomes embedded in the social relationships of the firm (Kogut and Zander, 1992). These social relationships then constitute the firm's 'new' potential absorptive capacity, from which subsequent developments of realized absorptive capacity start. Therefore, the development of a firm's absorptive capacity is path dependent: current levels of absorptive capacity help build higher levels in the future.

The current study applies this framework to the macro-level. Akin to the role of 'social integration mechanisms' at the firm-level, I argue that countries with high levels of trust have lower barriers of knowledge sharing and creation. These enable them to more efficiently convert 'raw' human capital, such as formal education, into 'real' technological progress and innovation, such as patents. This view is supported by a large body of literature dealing with trust as a facilitator of knowledge exchanges. This reconceptualization is tested using a cross-country empirical analysis. Two regressions are estimated in a seemingly unrelated regression framework to capture the path-dependent relationship between the development of trust and the development of a country's 'national absorptive capacity'. The latter is measured using the ArCo Technological Capabilities Index (Archibugi and Coco, 2004). The index combines data on (i) a country's ability to create new technologies, (ii) the ability to distribute these technologies (infrastructure), and (iii) the quality of human capital to absorb existing (technological) knowledge. Cross-country values for interpersonal trust are derived from the 'World Map of Trust' (ASEP/JDS). This map holds the aggregate (country level) answers to the survey question *"Generally speaking, would you say that most people can be trusted, or that you cannot be too careful when dealing with strangers?"*.

The first of the two regressions takes interpersonal trust as outcome variable, and relates this to the ArCo Technological Capabilities Index. Under the assumption that countries continuously aim to increase their capabilities (meaning that they should become more efficient in the conversion of potential to realized absorptive capacity; a process that is facilitated by trust), countries with high capabilities *should* have higher levels of trust. The second regression provides the rationale for this outcome: high-trust countries are more efficient in converting human capital (potential absorptive capacity) to technological progress (realized absorptive capacity). This efficiency measure, denoted as the efficiency factor η , is calculated by dividing sub-index (i) and (iii) from the ArCo index.

The results from the first regression show that countries with a high level of technological capability have a higher 'demand' for trust, which is indicated by the higher levels of trust for these countries. The results from the second regression provide a rationale for this higher demand: countries with higher levels of interpersonal trust are more efficient at converting potential to realized technological capabilities. In fact, the level of interpersonal trust explains approximately one fifth of the differences in the conversion efficiency. For a sub-sample of OECD countries, a sample which is typically used in empirical analyses on trust, this effect increases to over 50%. That is: half of the variance in efficiency by which OECD countries convert their 'raw' human skills into 'real' technological progress can

be accounted for by the country's level of interpersonal trust. An instrumental variables regression shows that these results are robust against endogeneity.

Relating trust back to economic performance, the results show that differences in the efficiency factor η explain about 70% of the variance in per capita income. This implies that 14% (full sample) to 35% (OECD) of the cross-country differences in per capita income can be related to differences in trust. Furthermore, the direct effect of trust from previous studies vanishes if the alternative explanation of the efficiency factor η is used to model the effect of trust.

This paper provides two novel perspectives on interpersonal trust. First, a substantial part of a country's trust level is endogenously created by (the demand for) technological development. Because (a) technological improvements are the result of technology imports or innovation, for which the literature shows that both rely heavily on trust, and (b) because technological development is path-dependent, meaning that technological growth can only occur in relatively small increments with each step building on the previous, then likewise the demand for trust is path-dependent and commensurate to the current level of technological capability. Indeed, the magnitude of the coefficient on technological capabilities in the regression explaining cross-country trust levels is large and usurps many of the 'control' effects that have previously been used in the literature on trust. Second, the study translates recent advances in the theory of the firm to the macro level to provide an alternative mechanism for explaining the economic effect of trust. The results show that trust *indirectly* influences economic development. This rearranges the conceptual role of trust as used in the transaction cost approach, which views trust as a direct facilitator of economic outcomes (through lowering transaction costs).

The remainder of this paper is organized as follows. Section 5.2 will present an overview of the literature. Section 5.3 will briefly explain the empirical strategy and addresses the potential endogeneity issue. Section 5.4 will deal with the data and variable operationalizations. In section 5.5, the results and discussion are presented. Finally, conclusions are provided in section 5.6.

5.2 Theoretical framework

5.2.1 Illustration: GDP per capita

A brief illustration of the problem considering the direct application of levels of trust to economic outcomes is provided in Figure 5.1.

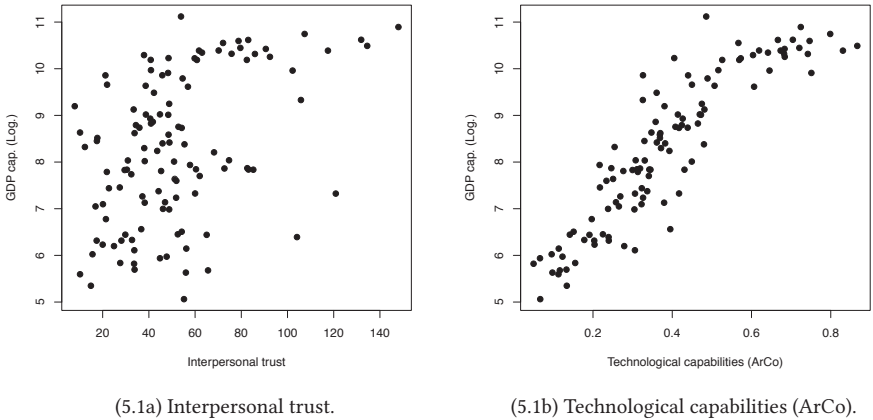


Figure 5.1: Linear relationship between *GDP cap. (Log.)* and: (a) Technological capabilities, (b) the level of interpersonal trust per country, *Interpersonal trust*. $N = 103$.

The left panel of the figure shows the cross-country relationship between *Interpersonal trust* and *GDP cap. (Log.)*, an economic variable that is often used in macro-economic studies on interpersonal trust (see for instance Whiteley, 2000; Knack, 2001; Realo et al., 2008; Bjørnskov and Méon, 2013; Peiró-Palomino and Tortosa-Ausina, 2013). The right panel, *Technological Capabilities (ArCo)*, measures each countries level of technological capability. This index (0-1) is from Archibugi and Coco (2004).¹ Higher values correspond to higher levels of technological development.

Figure (a) shows that there is a positive relationship between trust and per capita income. However, the relationship is not without error. For instance, if we consider the complete sample the relationship appears logarithmic (but still with large error). A simple regression reveals that trust explains roughly 20% of the variance in per capita income. Furthermore, a linear relationship is only found when lower income countries

¹The data used here are similar to the data from this study's empirical analysis. See the Data section for a description.

are discarded.² Conversely, figure (b) shows that the relationship between a country's technological capabilities and per capita income is highly linear. A single unit increase in the capabilities causes a similar increase in *GDP cap. (Log.)*. Here, a simple regression of both variables explains about 80% of the variance in the cross-country GDP per capita levels. The output of both regressions is provided in Appendix 5.A.

The question that emerges from the above is the following: if there is not a direct relationship between interpersonal trust and economic outcomes (or in the words of Berggren et al. (2008), it is 'shaky' at best), how should one interpret the previous findings of authors claiming a positive relationship? One recent development in the literature has been to investigate the effect of trust, given certain conditions. For instance, Aghion et al. (2010) condition the effect of trust upon the quality of the government and find that the economic impact is highest for societies with bad governance. Peiró-Palomino and Tortosa-Ausina (2013) show that the effect of trust on per capita income only holds for high-income societies (an argument which correspond with Figure 5.1a).

Similarly, earlier studies such as Knack and Keefer (1997), Whiteley (2000), Knack (2001) or Beugelsdijk and van Schaik (2005) use samples of relatively developed countries (OECD, Europe) to confirm the effect. However, once we move away from these relatively narrow samples and adopt a global cross-country analysis these effects seem to blur. In their review article of 65 recent studies relating trust (or the related 'social capital' concept) to economic performance, Westlund and Adam (2010) find that the significance of the effect is inversely related to a study's aggregation level. Firm-level studies more often find a positive effect of trust than cross-country studies do. The authors argue that this is due to empirical and statistical problems, such as the composition of the sample and selection of databases (p. 899). That is certainly one possibility. Another possibility would be that the operationalizations of the mechanism between trust and economic performance are more powerful for firm-level studies, and that a different operationalization is necessary for macro-level studies. The latter is addressed in the current study.

5.2.2 Knowledge-based theory of the firm

When Francis Fukuyama wrote *"Trust: The Social Virtues and The Creation of Prosperity"* (1996), he adopted the transaction cost theory of the firm for studying differences in performance of countries. In short, this theory proposes that firms exist because of their ability to minimize transaction costs (Coase, 1937). Because bargaining arms-length deals is expensive and their outcome uncertain (for instance, because information on the quality of inputs may be imperfectly transmitted in markets), firms emerge because integrating market exchanges within the boundaries of the firm mitigates these coordination problems.

During the 1990s this view was gradually challenged by management scholars, most notably by Bruce Kogut and Udo Zander. In a series of articles they re-conceptualized the role of firms. They proposed a knowledge-based theory of the firm, where firms are viewed

²For instance, a linear relationship can be drawn through the point cloud if one erases the observations below *GDP cap. (Log.)* = 8.

as organizations which specialize in the creation and transfer of knowledge (Kogut and Zander, 1992, 1996). In particular, firms are *"social communities in which individual and social expertise is transformed into economically useful products and services[...]* Firms exist because they provide a social community of voluntaristic action structured by organizing principles that are not reduceable to individuals." (1992, p. 384). The authors further argue that a firm's knowledge is 'competitively consequential': the development of new capabilities, such as new technologies, is dependent upon the ability to competitively apply current knowledge. In this respect, two types of knowledge can be discerned: know-what and know-how. The former consists of codified knowledge (facts, rules, recipes) which can be transmitted *by any individual* without a loss of information. The latter, know-how, is the understanding of how to organize the firm. This type of knowledge is harder to transmit, as it depends on subjective codification. Therefore, it is embedded in the firm's social relationships, which are all the human interactions that occur within the firm but which are not limited to the confounds of the firm (for instance, marketeer-engineer, sales-customer, and so forth). More specifically, it is embedded in how the firm organizes coordination and communication *between* social relationships.³ Because firms differ in their ability to transform their current level of know-what and know-how to new capabilities, there exist differences in firm performance.

This view does not run entirely counter to the transaction cost based theory of the firm. Rather, it extends it by making explicit the development of competitive advantage through the development of (new) knowledge. Firms do not only exist because they lower transaction costs *but also* because they provide the social context for learning which promotes innovation and motivated behavior. This view has been widely recognized in the management literature.⁴ It has, however, not penetrated the literature on interpersonal trust. Therefore, the following question emerges: instead of viewing trust as a facilitator for minimizing transaction costs, can we view trust as a facilitator for the sharing and creation of knowledge? If this idea is applicable to the macro-level, then a logical strategy would be to look the reasons that have been identified in the literature on how firms differ in their ability to exchange and create knowledge. A popular concept, in this respect, has been that of 'absorptive capacity'.

Absorptive capacity

Cohen and Levinthal (1990) describe how firms use prior knowledge to value, assimilate and create new knowledge. Prior knowledge, such as the schooling and training of employees, determines how new knowledge is acquired and internalized. Once internalized, the new knowledge may be applied to commercial ends (products, services, productivity improve-

³For instance, how the engineering department translates product ideas from designers. In their 1996 article, Kogut and Zander describe this as follows: *"Firms differ in what they can do. [...] The roots of this inertia lie in the wiring of the human cognition to acquire tacit procedural knowledge as the basis of interaction with other individuals."* (p. 515).

⁴To give an idea: as of November 2014, Kogut and Zander's 1992 article "Knowledge of the firm, combinative capabilities, and the replication of technology" has been cited over 10,000 times.

ments) that increase a firm’s competitive advantage. This ‘absorptive capacity’ of the firm, thus, determines the differences in the competitive advantage between firms.

The development of absorptive capacity depends on the one hand on the quality of the available prior knowledge in the firm, and on the other hand on “communication between the external environment and the organization, as well as among the subunits of the organization, and also on the character and distribution of expertise within the organization” (Cohen and Levinthal, 1990, p. 132). Zahra and George (2002) provide an intuitively appealing schematic of this process (Figure 5.2). They divide the process in two parts. The first deals with the **potential** absorptive capacity of the firm. Prior knowledge enters the firm through internal and external knowledge sources, such as through the training of employees, through inter-organizational relationships (licensing, contracting, alliances), or through past experience (with certain customers or business markets). Given the prior knowledge of all individuals in the organization, and the complementarity that exists between them (i.e. some employees may have manufacturing skills, others may have marketing skills), this part consists of the knowledge a firm can *potentially* acquire and put to practice. The second part of the process, denoted by the **realized** absorptive capacity of the firm, is the amount of potential absorptive capacity that has been transformed into innovations (for instance: patents, formulas), new product developments, production improvements and other commercial ends. These realizations incrementally increase the absorptive capacity of the firm, and increase its competitive advantage.

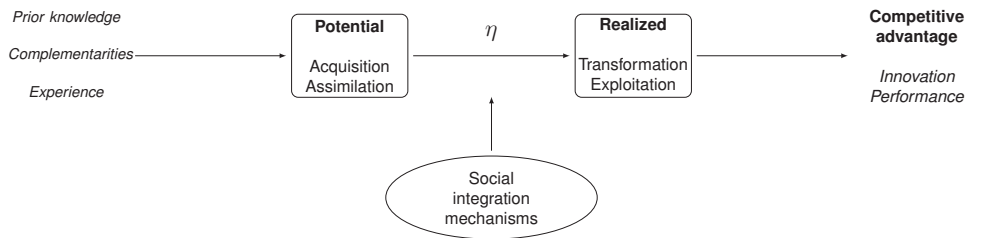


Figure 5.2: A model of absorptive capacity. Source: Zahra and George (2002).

Not all firms are equally capable of converting potential absorptive capacity to realized absorptive capacity.⁵ Zahra and George (2002) introduce the Efficiency Factor η , or the realized divided by the potential absorptive capacity, to express the efficiency of this conversion (see figure).⁶ The authors argue that firms that are more successful at lowering

⁵Many real world examples can be cited here. For instance, despite the fact that Kodak Eastman was one of the most competitive players in the global market for analog photography (with many of the company’s engineers holding patents of specific photographic and cinematographic techniques), its managers completely missed the transition towards digital techniques resulting in a 80% decline in the company’s workforce (Lucas Jr. and Goh, 2009).

⁶In their article, Kogut and Zander (1992) refer to a similar concept as ‘combinative capability’, which is the

barriers to information sharing⁷ are more efficient (i.e. approach $\eta = 1$) in exploiting potential absorptive capacity.

The authors suggest that 'social integration mechanisms' allow to improve this efficiency by facilitating knowledge-sharing. These are informal social mechanisms that promote the sharing of ideas, interpretations and trends (for instance, through knowledge sharing within firms or social networks such as business clubs) or more formal mechanisms, which consist of systematic efforts to improve understanding and comprehension (through R&D alliances, or connections with local knowledge centers such as universities).

Furthermore, the development of absorptive capacity is path-dependent. Sustained competitive advantage stems from the *accumulation* of absorptive capacities: prior knowledge builds new knowledge. By definition, the complexity of new knowledge is higher as compared to the complexity of existing knowledge. Increments in absorptive capacity, therefore, are accompanied with an increase in the functional expertise within the firm (Kogut and Zander, 1992).⁸ As a result, certain communities within the firm become more specialized: there occurs a division of labor to accommodate the increased complexity (Kogut and Zander, 1996). This, in turn, increases the need for coordination and communication between individuals through 'social integration mechanisms': a feedback loop is established (Todorova and Durisin, 2007).⁹

Macro-economic applications

Given the intuitive appeal of the concept of absorptive capacity it has received a lot of attention from management scholars (for recent review papers see Zahra and George 2002; Lane et al. 2006; Todorova and Durisin 2007). However, some of the presented ideas have also found their way to the economics literature, in particular to segments dealing with cross-country differences in development. Two strands of literature have emerged from this.

The first strand simply applies the concept to the macro-level. For instance, authors such as Mowery and Oxley (1995) and more recently Criscuolo and Narula (2008) use the concept of 'national absorptive capacity' to describe cross-country differences in the phase of technological development (i.e. catching up, or being at the technological frontier). The idea in these studies is similar to the mechanism presented in firm-level studies: absorptive capacity, usually operationalized as some form of human capital, increases a country's ability to 'learn' frontier technologies and (or) create new technologies through innovation. Furthermore, Criscuolo and Narula (2008) argue that national absorptive capacity is path-dependent and evolves with the level of technological development: learning largely occurs

ability of an organization to combine different sources of knowledge into new knowledge. Similarly, Nahapiet and Ghoshal (1998) use the term 'combination capability'.

⁷Or in the words of Cohen and Levinthal (1990), those firms with superior 'communication structures'.

⁸A typical example of this is the bifurcation of product development activities into specialized components: marketing, sales, and manufacturing. See for instance 'The Toyota product development system', (Morgan and Liker, 2006).

⁹Note: this feedback loop is not drawn in Figure 5.2. I will come back to the accumulated development of absorptive capacity in the following sections.

in the 'catching up' phase and stems from trade and inward FDI, whereas innovation occurs at the technological frontier and stems from outward FDI in the form of R&D and strategic alliances.

A second strand of literature has focused more on the conversion between potential and realized absorptive capacity through 'social integration mechanisms'. This literature is better known by the term 'social capability', introduced by Ōkawa and Rosovsky (1973) in their study on Japanese economic growth. Their hypothesis was that Japan had been able to quickly catch-up to the frontier level of technology (and enjoy high economic growth rates) because of its *"increasing capability of borrowing and absorbing more advanced methods based on a well-functioning socio-political infrastructure"* (p.39). Subsequent empirical studies have aimed to quantify this 'well-functioning socio-political structure' in a number of ways. Abramovitz (1986) uses the years of education of the population as a rough proxy for the quality of a country's social, political, commercial, industrial and financial institutions (p. 388). De Long (1988) uses a country's religious denomination to show that some religions (most notably Protestantism) facilitate specialization in manufacturing and high investment rates (which increase the technological capability). Dahlman and Nelson (1995) propose that the skills necessary to absorb knowledge are similar to those necessary to create new knowledge. The authors argue that there is no such thing as technological development through 'turn key' solutions (i.e. simply procuring technology without fully understanding it), despite the fact that many consider technology to be a public good. They introduce 'social absorption capability', which throughout their article is operationalized as education (using, among others, the literacy rate and school enrollment levels), to suggest that technology requires 'mastering'. Alternatively, Temple and Johnson (1998) use an index for social capability as previously constructed by the development economists Adelman and Morris (1967). The index combines data from formal and informal assessments on 21 social, political and economic indicators. Their paper focuses on economic growth differentials in developing countries. Similarly, Verspagen (1999) uses a broader notion of social capabilities in the form of educational institutions (providing human capital), the banking system (which provides capital for investments in technology) and the political system. In more recent studies such as Fagerberg and Srholec (2008) these broad distinctions are kept, mainly because data availability allows the operationalization of many different capabilities (political, technological, economic).

5.2.3 Trust, technological capabilities and η

Although a substantial amount of macro-level studies incorporate the idea of absorptive capacity (or its macro-level equivalent: 'technological capabilities'), very few apply the idea rigorously. In reality, most studies use some form of human capital to study the problem. This is unfortunate, as the framework can be directly modeled.

The notion of the efficiency factor η is a good starting point. If η determines the efficiency by which firms transform potential to realized absorptive capacity, then applying this logic to the macro-level simply implies that countries that are more efficient in this process have higher levels of 'national absorptive capacity', or technological capabilities.

In this framework, I propose that interpersonal trust can serve as a macro-level proxy for these 'social integration mechanism'. This idea follows Adler (2001) who provides a similar argument for this conceptual role of trust at the firm level: if knowledge is the quintessential element for developing competitive advantage, then we ought to see an increasing role for trust as 'currency' for inter- and intrafirm exchanges.

At the macro-level, however, we do not observe these individual exchanges. Therefore, it is necessary to make an abstraction of these processes. In this respect, there are basically two ways a country can improve upon its technological capability. It can either (i) adopt superior technologies from the technological frontier, or (ii) create new technologies through innovation. Both options are positively affected by trust. The evidence I present for this is based on the following empirical observations.

Empirical support: trust and knowledge sharing

The first option to increase a country's technological capability is to adopt (imitate) technologies from the existing technological frontier (Acemoglu and Zilibotti, 2001; Griffith et al., 2003; Acemoglu et al., 2006; Caselli and Coleman II, 2006). In terms of the absorptive capacity framework (Figure 5.2), this relates more to the acquisition and assimilation of knowledge. There are a number of ways in which trust may affect a country's ability to do so.

In order to increase their capabilities developing countries will have to import technologies from more advanced countries. Because of the specific nature of knowledge, knowledge-sharing poses a risk. Once knowledge is shared its value diminishes rapidly, as reproduction of knowledge comes at very little costs. Therefore, the development of technological capabilities through absorption usually occurs through trade between firms (where a price is obtained for knowledge), through cooperation between firms, or by acquiring knowledge from abroad (for instance, through joint ventures or mergers) (Knight and Liesch, 2002). The latter may also occur within firms, if a firm sets up a subsidiary abroad. All of these elements have previously been shown to be positively affected by interpersonal trust. Many recent works can be cited here: Bouty (2000) documents the effect of trust for the diffusion of R&D knowledge among scientists, Barr (2000) shows that trust positively affect the transfer of technological know-how in the manufacturing sector, Koka and Prescott (2002) investigate trust in strategic alliances for the global steel industry, Autio et al. (2005) link trust to knowledge sharing between software companies, Holste and Fields (2010) relate tacit knowledge sharing among co-workers to trust, Kallio et al. (2010) show that trust influences the absorptive capacity of firms in Finland, Maurer et al. (2011) confirm the relationship for engineers in Germany, Fisher (2013) shows the effect of trust for agents in the cattle industry in the United Kingdom, while Chen et al. (2014) focus on Taiwanese industrial managers. Analogously, Lucas (2005) and Rotsios et al. (2014) show that managerial best practices are more easily implemented when inter-organizational trust is high.

Direct applications of trust to knowledge sharing on the macro-level are absent. Indirectly, one may arrive at this link. For instance, Miller and Upadhyay (2000) and Keller (2001)

argue that differences in trade patterns explain cross-country differences in knowledge diffusion and productivity. Guiso et al. (2009) investigate trade flows between countries and finds that trust between managers from different countries partially explains differences in trade. Their study, however, focuses on national biases in trade and does not apply trust in the way it is used in this study.

Empirical support: trust and knowledge creation

The second option for countries to take is to increase their realized absorptive capacity through the creation of new knowledge (i.e. innovation) (Aghion and Howitt, 1992; Griliches, 1998; Acemoglu et al., 2006; Ark et al., 2008). In terms of the absorptive capacity framework (Figure 5.2), this relates more to the transformation and exploitation of knowledge.

Two effects of trust can be mentioned here. The first is the *indirect* effect of trust on the propensity to innovate through lowering monitoring costs (Knack and Keefer, 1997). Agents in high-trust societies simply have more time and resources available to develop innovative products and services, thereby increasing a society's realized technological capabilities. The second effect is closer to the 'efficiency factor η operationalization' as per Zahra and George (2002). In this respect, Nahapiet and Ghoshal (1998) provide the most comprehensive view of the role of trust in creating firm-specific knowledge (operationalized in their article under the broader 'social capital' term). Firms are able to create knowledge because of the social capital available in the network of individual firm members. Put differently: a firm's 'intellectual capital' is the *"knowledge and knowing capability of a social collectivity, such as an organization, intellectual community or professional practice"* (p. 245). Trust motivates individuals and firms to exchange and combine current intellectual capital into new intellectual capital (p. 251), thereby increasing the competitive advantage of the firm. This sets it apart from the transaction-cost based theory of the firm, in that the firm's main advantage lies in engaging in *"collective investments [that] provide the unplanned and unstructured opportunities for the accidental coming together of ideas that may lead to the serendipitous development of new intellectual capital"* (p.258).

Empirical analysis using various aggregation levels can be cited to support both effects. Landry et al. (2002) relate firm specific trust to the propensity to innovate for Canadian manufacturing firms and find a positive relation. Tsai and Ghoshal (1998) show that trust increases the tendency to innovate for multinational enterprises. Furthermore, Hauser et al. (2007) and Laursen et al. (2012) show that firms located in high-trust regions indeed have a higher probability to innovate. Similarly, Akcomak and ter Weel (2009) suggest that engaging in innovative activities poses risks for capital providers (demanding a return on investment) and researchers (aiming to increase the stock of knowledge). Trust allows to hedge this risk, and as such has a positive effect on the regional investments in innovations. Fountain (1998) argues that spill-overs from public institutions (i.e. knowledge from universities and other public research facilities) to private firms more easily occur in high-trust societies. The author provides the development of Silicon Valley (USA) as an

example of this effect of trust.¹⁰ Hansson et al. (2005) show that trust facilitates knowledge transfers between public and private research institutions in science parks in Denmark and UK. Finally, Cooke and Wills (1999) and Dakhli and De Clercq (2004) show that differences in innovation between countries can be explained for by differences in trust.

5.2.4 Path-dependent relationship

A final element that needs to be addressed is the recurring theme of knowledge cumulativeness. All reviewed articles speak of this in some way: Kogut and Zander (1992) discuss the fact that the development of knowledge is 'competitively consequential', Zahra and George (2002) speak of absorptive capacity as an incremental process, Todorova and Durisin (2007) use the term 'path dependence', and Nahapiet and Ghoshal (1998) even go as far as suggesting that the relationship between trust (social capital) and absorptive capacity is dialectical: one causes the other, which then feeds back to the former.

Figure 5.3 on page 115 summarizes this process. Assume that a country is located at the hypothetical technological development level denoted by $T = 1$ (where again the technological capability is expressed as an index from 0-1, with 1 being the highest level of technological capabilities). Furthermore, assume that the country is always willing to move to a higher level of technological capability: the demand for technological development is positive. If interpersonal trust facilitates the absorption and creation of knowledge, and if these are the two elements that allow a country to develop technologically, then a positive demand for technological development should be followed by a positive demand for interpersonal trust (+ Trust). This argument is based on the fact that the introduction of increasingly complex technologies demands a higher division of labor. Put simply: as technological complexity increases it becomes increasingly difficult for individuals to 'master' all technologies. This is similar to the firm level process, where an increase in the absorptive capacity of the firm translates into a higher level of specialization (Kogut and Zander, 1996). This increases the need for coordination, communication and trust (Nahapiet and Ghoshal, 1998; Adler, 2001). Similarly, given that a country would always like to improve its position, the technological capability will increase the 'demand' for interpersonal trust.¹¹ As a result of this process, the number of 'high-trust' individuals in society increases (y-axis).

The attainable country-specific frontier level of technology is the vertical line, 'Supply of currently attainable technology'. Note that this is only modestly higher than the

¹⁰ A similar argument is put forward by Cohen and Fields (2000). The idea of trust as a central concept for explaining the ability of individuals to cooperate in Silicon Valley is demonstrated by the following quote: "Silicon Valley is notoriously a world of strangers; nobody knows anybody else's mother there. [...] In Silicon Valley, social capital [trust] can be understood in terms of the collaborative partnerships that emerged in the region owing to the pursuit by economic and institutional actors of objectives related specifically to innovation and competitiveness." (p. 3).

¹¹ This logic can be traced back to Durkheim (1893) [1984], who argued that the division of labor would bring a solidarity in society based on a general sense of cooperation (as opposed to a solidarity based on the traditional structures of the family, religion, race etc.). For recent studies on how this process works on the firm level see Six (2007) and Six et al. (2010).

technological capabilities level of $T = 1$, indicating that future technological capabilities are complementary to a country's current abilities. Large 'jumps' in capabilities are hard to achieve, because the development of technological capabilities is dependent upon the *current* absorptive capacity of a country (i.e. it is dependent on the prior knowledge and skills that are available). By the same logic, large 'jumps' in trust are hard to achieve. The increase in trust lowers the barriers to information sharing, which facilitates the conversion of potential to realized technological capabilities (+ η). This allows the country to move to the higher technological capability level at $T = 2$.

I note that the literature on trust has identified several other mechanisms for the development of trust. Therefore, it is likely that the development of technological capabilities is not the only mechanism. The next sections will discuss the mechanisms that are controlled for in the estimation.

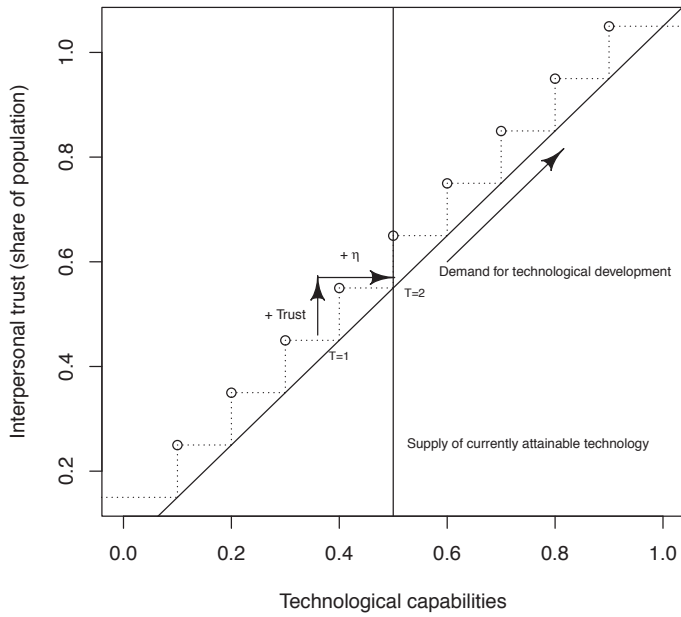


Figure 5.3: Relationship between a country's technological capabilities and trust. Under the assumption that countries continuously seek to increase their technological capabilities, the demand for technological development necessitates the development of higher levels of trust. For developing countries, higher levels of trust allow for the absorption of knowledge from the technological frontier. For developed countries, higher levels of trust facilitate the development of innovations.

5.3 Empirical strategy

To show that the economic effect of trust can be better appreciated by using the absorptive capacity framework the following two-part strategy is used. First, an empirical model which takes into account the path-dependent relationship between the development of technological capabilities and trust through the efficiency factor η is estimated. Second, the outcome from this model is used to show how trust *indirectly* influences economic outcomes by relating η to the per capita income level for a cross section of countries.

5.3.1 Empirical model

To investigate the link between technological capabilities and interpersonal trust the following system of equations is proposed:

$$\begin{cases} Trust_i &= \beta_0 + \beta_1 Tech. Cap._i + \beta_2 \mathbf{Trust\ controls}_i + \varepsilon_i \\ \eta_i &= \beta_0 + \beta_3 Trust_i + \varepsilon_i \end{cases}, \quad (5.1)$$

with $Trust_i$, the level of interpersonal trust of country i , $Tech. cap._i$ the level of technological capability, **Control variables** $_i$, a vector of control variables derived from the literature, and η_i the efficiency factor.

In the terms of Figure 5.2 (on page 108) trust (or its firm level equivalent 'social integration mechanisms') is responsible for the efficiency by which potential to realized capabilities are transformed. The first equation, with $Trust_i$ as outcome, takes the process of developing technological capabilities as 'having occurred'. In terms of Figure 5.3 (on page 115), $Tech. Cap._i$ is the observed level at $T = 1$, and $Trust_i$ is the observed level of interpersonal trust between $T = 1$ and $T = 2$ (+ Trust). The second equation zooms in on this process, and divorces the complete process of developing absorptive capacity into its two components: potential and realized. The efficiency of conversion between these two, η_i , is related to the trust level within country i . Here, the level of interpersonal trust serves as an input.

The system of equations takes into account the fact that the process between the development of trust and technological capabilities is path-dependent. An analysis that is completely true to this nature is hard to achieve: longitudinal data on the development of trust and the development of technological capabilities (in the form of a standardized index) are not available. I would like to mention at this point that given the data used for this study, the first equation of the system is the most accurate in terms of temporal causality: data for the interpersonal trust values have mostly been collected after the year 2000, whereas data on each country's technological capability are from before 2000. The second equation, therefore, uses a-causal data (from a temporal perspective). This was done to assure the largest number of observations possible.¹² Related to this is the fact that the cross-sectional

¹²An additional estimation was performed using an alternative longitudinal data set, which addresses these issues. Please see Section 5.5 and Appendix 5.E

nature of the system of equations (5.1) introduces endogeneity in the form of a potential reverse causality.

Endogeneity

Assuming that a country has a demand for the development of technological capabilities, an increase in trust may either facilitate the development of innovations, or the absorption of knowledge from the frontier. Econometrically, the problem may affect the estimates through a potential correlation between the $Tech.cap._i$ and ϵ_i . An analogous argument holds for the second equation of the system.

To mitigate this causal feedback mechanism an instrumental variables regression is adopted. To allow for an unbiased estimation of equation 5.1, a number of instrument properties should be satisfied. First, the instruments should have a high correlation with the potentially endogenous variable. Second, the interpretation of the correlation should be meaningful. Third, the instruments should not correlate with ϵ_i .

Regression: Trust

A large number of instruments satisfy the correlation argument. However, many are either related to one or more sources for technological development that make up the ArCo index (such as the level of education), or are directly related to the level of interpersonal trust (such as a country's climate, which affects its technological capabilities but has similarly been found to explain differences in the trust level).¹³ A candidate instrument should therefore explain the cross-country differences in technological capabilities, without explaining the differences in trust.

From the perspective of the proposed mechanism, this can only be achieved by looking at how countries obtain knowledge. When this phase can be addressed exogenously an unbiased estimation is feasible. In this respect, Keller (2001) and Özak (2013) suggest that the scope of knowledge diffusion pertaining to frontier technologies is limited by geographical distance. In particular for technological innovations that occurred in less modern times, such as those during the Industrial Revolution, knowledge dissipation was strongly tied to trade. For instance, the steam engine, invented in the United Kingdom, only became commonplace in the rest of the world after trade and colonization (Cottrell, 1955). In the framework that is suggested in this paper, distance is unspecified: the model functions regardless of the geographical source of knowledge or innovation (i.e. the '+ Trust' phase should occur regardless of the source of knowledge).

An exogenous source of variance for the $Tech.cap._i$ is therefore found in the distance to the technological frontier. The latter is formulated as the geographic location with the highest level of technological capabilities (Caselli and Coleman II, 2006). To account for differences in technological capabilities due to the distance from the technology frontier, I use the great-circle distance (in kilometers) between the capital of each country and two

¹³See Engerman and Sokoloff (1997) and Durante (2009).

technology frontiers. First, I use Dudley, United Kingdom. The Newcomen atmospheric engine, invented by Thomas Newcomen and deployed at the mines of this town in 1712, is considered to be the first functional steam engine. Its invention is often marked as the beginning of the Industrial Revolution. Secondly, I calculate the distance to the current technological frontier: Silicon Valley, USA. This area is widely regarded as the 'birth place' of the development of silicon transistors, which propelled the development of microcomputers (Arun Rao, 2013). In theory, if the transfer of technology occurs largely through trade then countries that are removed further from both these locations should have lower levels of technological capabilities.

Regression: Efficiency factor η

To estimate the effect of trust in an unbiased manner, the following instrument is proposed for the second equation of the system. Ahn and Esarey (2008) argue that trust in a society can develop "*if reliable credentials allow people to distinguish between trustworthy and untrustworthy partners*" (p. 151). Although much of this information will be transmitted through day-to-day interactions of individuals, other sources may also provide this information. For instance, media outlets such as newspapers and television provide information on the trustworthiness of individuals through the coverage of scandals or through information provided by whistle blowers. Any form of media is typically considered to be a 'reliable credential' if it informs the public in an objective manner. The probability of the latter is highest if the press enjoys substantial freedom (Nixon, 1960). Therefore, the freedom of the press is used as an instrument for interpersonal trust.

5.4 Data

5.4.1 Regression: Trust

Interpersonal trust

The 'World Map of Trust', maintained by ASEP/JDS (<http://www.jdsurvey.net>), combines interpersonal trust values from the following surveys: European and World Values Surveys, Globalbarometer, Latinobarómetro, and East-Asian barometer. The database only reports trust values for the most recent survey from a country. The years that these surveys were conducted are therefore different: starting with 1997 (Armenia), and ending in 2008 (among others: Brazil, Uruguay). A country-specific overview is posted in Appendix 5.B. Although there are only a few countries with "older" observations (the median year of all observations is 2006), I do acknowledge that this approach will add some noise to the econometric estimation. However, given the relatively short time span of the observation this effect will most likely be small.

All surveys present individuals with the question: "*Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?*". Respondents are asked to rate the extent to which they agree with the statement on a 2

point scale (where 0 indicates that “You can’t be too careful”, and 1 indicates that “Most people can be trusted”). This statement has previously been shown to relate to outcomes from trust-game experiments (Glaeser et al., 2000; Naef and Schupp, 2009; Sapienza et al., 2013). Survey-specific sampling weights have been included by ASEP/JDS. Although most empirical studies take the percentage of people answering the survey statement positively, the World Map of Trust score uses the following formula:

$$\text{Interpersonal trust}_i = 100 + (\text{Most people can be trusted \%})_i - (\text{You can't be too careful \%})_i.$$

A value of > 100 indicates that the majority of individuals thinks that most people can be trusted, whereas a value of < 100 indicates that most think you can’t be too careful. A simple (Pearson) correlation between this metric and the percentage of survey respondents answering *Most people can be trusted* % from the World Values Survey¹⁴ reveals that both correlate highly (0.88). The ASEP/JDS measure is however preferred, because it includes 50% more countries than the WVS.

Technological capabilities: ArCo Index

Apart from specific data on technological development (such as patent data), a number of indexes exist that aim to measure a country’s complete ‘set’ of technological capabilities. Most of these indexes combine data on a number of dimensions. Examples are the United Nations Technology Achievement Index, the United Nations Industrial Scorebord or ArCo Technological Capabilities Index. Because there exist large differences in interpersonal trust levels between countries, candidate indexes should be equally informative for technologically developed and developing countries (i.e. a single index should be applicable to both sets of countries).

The ArCo Technological Capabilities Index (Archibugi and Coco, 2004) has these properties. The index is built from three sub-indexes which aim to capture different sources of technological development:

- i. *Technology creation* refers to the amount of codified knowledge that is produced in a country. To measure the ability of a country to create new technologies, the number of per capita patents (by country residents) and scientific articles¹⁵ is recorded.
- ii. *Technology infrastructure* measures the ability of a country to distribute and diffuse knowledge. To measure the quality of the technological infrastructure, the number of Internet users, telephone lines and mobile phones and consumption of electricity are used (population adjusted).

¹⁴Values from the WVS were collected for the period 1997-2008. The simple average for each country was calculated, resulting in observations for 79 countries. The correlation between this measure and the ASEP/JDS is 0.88.

¹⁵Which is based on the Science Citation Index (Garfield, 1964).

- iii. *Human skills* aims to measure the ability of a population to absorb knowledge. Human skills are measured as the percentage of individuals enrolled in tertiary education, the average years of total schooling and the literacy rate.

These sources are combined into a single index which takes on a value between 0 and 1 (where 1 is perfectly capable of transforming potential capabilities into technological advancements). Each sub-index is calculated by dividing a country's performance on a single measure by the maximum value for the sample.¹⁶ All sub-indexes account for 1/3 of the final ArCo index. Data on each of the elements that constitute the index are from 1997 to 2000. I note that in principle the ArCo index uses a closed economy approach, where it is assumed that knowledge from abroad does not directly increase technological capabilities. The authors show that when this is relaxed, and measures such as inward foreign direct investments and the import of capital goods are considered, the ranking and index scores remain virtually similar.¹⁷ However, due to data availability the inclusion of technology imports significantly reduces the number of observations. As such, the original ArCo index is used in this study.¹⁸

Control variables

Several control variables are introduced which largely follow the empirical analysis of Bjørnskov (2006). Note that where possible the control variables were collected (and averaged) for the period used by the authors for the creation of the ArCo index: 1997-2000.

Protestantism Societies with a large share of Protestants score high on interpersonal trust (Bjørnskov, 2006; Delhey and Newton, 2005; Welch et al., 2007). It has been argued that although the work ethic of Catholics and Protestants is similar, Protestantism has promoted an alternative social ethic that facilitated the development of impersonal trade (Arruñada, 2010). The latter has been shown to rely on interpersonal trust (Guiso et al., 2009). Country data on the share of Protestants (as percentage of the total population for 1980) is recorded from La Porta et al. (1999).¹⁹

Institutional environment Through a superior implementation of checks and balances societies are able to limit corruption and exploitation, and build and support institutions that promote high levels of trust. Although most studies conclude that the causality runs from trust to the quality of the institutional environment (Bjørnskov and Méon, 2013), there will undoubtedly be synergies between the development interpersonal trust and the

¹⁶For instance, the maximum number of patents per million people for the complete sample is 230 (Japan). The score for the United Kingdom (56 patents per million people) on this element of the sub-index thus becomes: $56/230 = 0.245$.

¹⁷The correlation between the original and adjusted ArCo index is 0.99.

¹⁸Note that by using a measure of distance to the technological frontier in the first-stage regression (to model the idea of international knowledge spillovers), the closed economy construction of the ArCo index is somewhat relaxed.

¹⁹Data for Hong Kong was derived from Leung and Chan (2003).

quality of the government, the fairness of government officials and the occurrence of violence and crime in a country. To control for such an effect, I use the Worldwide Governance Indicators (Kaufmann et al., 2011). These data are constructed from different sources, such as from surveys, NGO's and public sector organizations, and aim to capture a country's perceptions on the quality of governance. Six indicators are available, of which I choose the indicator 'Regulatory Quality'. It measures *"the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence"* (Kaufmann et al., 2011, p. 4). Of all indicators, this variable has the highest potential for measuring the causality from the quality of the institutional environment to trust. Because of data availability, the average value for "Regulatory Quality" for the period 1997-2000 was calculated per country.

Furthermore, a dummy for Communism (1=past or present Communist country) is added. This controls for adverse effects of socialist rule on trust, for instance, through oppressive behavior of dictators towards individuals (Paldam and Svendsen, 2001), differing individual preferences for government intervention (in particular for former socialist countries that have now transitioned to democratic rule, see Alesina and Schuendeln, 2007) and the underdevelopment of associational life as measured through the relative absence of voluntary organizations and non-governmental organizations (Rose, 1994).

Additionally, previous research has shown that monarchies on average have higher levels of trust. Bjørnskov (2006) argues that monarchs fulfill the function of role-model in society, thereby instilling a sense of morality within individuals that inhibits socially unwanted behavior. A dummy is added for each monarchy in the sample. Data are from the regime type data set from Wahman et al. (2013).

Fractionalization It is generally understood that social diversity may hamper the development of trust (Dincer, 2008). Alesina et al. (2003) provide three measures of fractionalization that have previously been related to differences in trust between countries (Bjørnskov, 2008*b*). Data are made available through the MacroDataGuide hosted by the Norwegian Social Science Data Services. Alesina et al. (2003) note that the majority of data for calculating the fractionalization indices are based on relatively recent data (various sources, most prominently: Encyclopedia Britannica, 2001; Cia World Factbook, 2000).

First, religious heterogeneity is used. Alesina and La Ferrara (2002) and Lancee and Dronkers (2011) show that when societies are religiously more diverse, trust levels are lower. Furthermore, both articles show that ethnic diversity hampers the development of trust (potentially through the so-called 'hunkering down' of racially different individuals, see Putnam, 2007). Third, differences in languages spoken can cause problems associated with asymmetric information exchange, where the barrier of language simply keeps others (and their true motivations) 'unknown' due to an absence of interaction or simple miscommunication. This may inhibit the extension of the radius of trust, and on a macro-scale thus hamper the development of trust (Anderson and Paskeviciute, 2006). All three variables are coded as the probability of two randomly selected citizens of a country being different (in terms of religion, ethnicity or language). As such, higher values indicate that the country's

population is more diverse.

Gini It has been shown that large differences in income in a country are detrimental to the development of trust (Bjørnskov, 2008b). Income differences are easily observable for individuals: large differences may therefore polarize societies by increasing feelings of unfairness. Therefore, the Gini-coefficient from the World Income Inequality Database is added (Solt, 2009). Per country, a single average value for the period 1997-2000 was calculated.

Instruments

Both the longitude and latitude for each country's capital were extracted from the World-bank. The longitude and latitude coordinates for Dudley, United Kingdom are -2,081111999999962 and 52,512255. The coordinates for Silicon Valley, USA are -122,0363496 and 37,36883.²⁰ Both coordinates were obtained from the website <http://www.distancesfrom.com>. The great circle distance in kilometers between both sets of coordinates and the coordinates of each country's capital was calculated using the R package 'fields' (Furrer et al., 2013).

5.4.2 Regression: Efficiency factor η

Operationalization

The Efficiency Factor η of the conversion between potential and realized absorptive capacity is calculated as follows:

$$\eta_i = \log \left(\frac{\text{Technology creation index}_i}{\text{Human skills index}_i} \right),$$

where both the nominator and denominator are derived from the aforementioned *ArCo Technological Capabilities Index*. Akin to the prior knowledge of the firm, as well as the "distribution of expertise within the organization" (Zahra and George, 2002, p. 132), the *Human skills index_i* takes into account the 'potential' absorptive capacity of a country. The *Technology creation index_i* proxies for the 'realized' absorptive capacity. This sub-index recognizes that technological progress can be sourced from the public sector (number of scientific articles) as well as from the private sector (number of patents per country resident). A logarithmic transformation (base e) is performed to have the Efficiency factor η better approach a normal distribution.

Because all sub-indexes are normalized to take on values between 0 and 1, η can be interpreted as follows:

$$\eta_i = \begin{cases} < 0 \rightarrow 1 & \text{not efficient} \\ 1 & \text{perfect} \\ > 1 & \text{synergistic} \end{cases},$$

²⁰These coordinates refer to the City of Sunnyvale, USA, which is a central town in the area that is referred to as Silicon Valley.

where for values between $0 \rightarrow 1$ more human skills are needed then necessary to create a technology, for values at 1 the conversion is 1:1, and for values above 1 there is a synergistic effect: more technology is created than expected, given the amount of human skills of the population.

Instruments

The 'Freedom of the Press score' from Freedom House is used to measure each country's level of press freedom (<http://www.freedomhouse.org>). The score combines data on the degree of freedom of print publications, broadcasts, and internet of most countries in the world. Four elements are used to construct the score: (i) laws and regulations that influence media content, (ii) political pressures and controls on media content, (iii) economic influences over media content, and (iv) repressive actions (i.e. physical violence against journalists, censorship, expulsion, harassment). The score ranges from from 0 (most free) to 100 (least free).

5.4.3 Economic interpretation

Each country's gross domestic product per capita is extracted from the World Bank database. GDP is calculated as: "*the gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products*".²¹ All data are in current U.S. dollars. Dollar amounts are converted from domestic currencies using single year official exchange rates.

5.4.4 Variable overview

An overview of the aforementioned variables, including summary statistics, is presented in Table 5.1. The table shows the large differences in *Interpersonal trust* on the one hand (ranging between a score of 7.9 for Trinidad & Tobago and 148 for Norway), and the large differences in the *Efficiency index* η and technological capabilities as measured through the *ArCo Tech. Cap. Index* on the other. Note that I have tried to retain the unit of analysis of the original source as much as possible. Therefore, some percentages are expressed between 0-1, and some between 0-100. Furthermore, both instruments are reported untransformed to allow for an intuitive reading in kilometers. They were however logarithmically transformed (with base e) prior to the empirical analysis.

A correlation matrix is presented in Appendix 5.C. Some correlations are relatively high. For instance, *ArCo Tech. Cap. Index* and *Rule of Law* have a correlation coefficient of 0.8. This may introduce some problems surrounding collinearity. I will return to this issue in the Results section.

²¹See <http://data.worldbank.com/indicator>

	Mean	St. Dev.	Min	Max
<i>Dependent variables</i>				
Interpersonal trust	51.02	28.27	7.9	148.0
Efficiency factor η (Log.)	-3.47	2.04	-7.2	0.2
<i>Control variables</i>				
ArCo Tech. Cap. Index	0.39	0.19	0.1	0.9
Protestants (%)	12.76	22.71	0.0	97.8
Monarchy (1=yes)	0.17	0.38	0.0	1.0
Rule of Law	0.17	0.98	-1.4	2.0
Communism (1=yes)	0.27	0.45	0.0	1.0
Ethnic fractionalization	0.38	0.26	0.0	0.9
Language fractionalization	0.30	0.27	0.0	0.9
Religion fractionalization	0.39	0.26	0.0	0.9
Gini	38.43	10.00	22.3	64.9
<i>Instruments</i>				
Distance to Dudley (km.)	5513.06	3894.40	175.0	18766.3
Distance to Silicon Valley (km.)	10388.95	3171.77	2988.2	17814.9
Freedom Press	38.92	20.74	5.0	84.3
<i>Illustration</i>				
GDP cap. (\$)	8118.98	10945.16	125.7	46343.0

Table 5.1: Descriptive statistics. $N = 103$.

5.5 Methods and results

5.5.1 Model estimation and results

To estimate the proposed system of equations two estimation techniques are used: (i) seemingly unrelated regression (SUR), which does not take into account the potential endogeneity problem, and (ii) 3SLS regression, which extends SUR by modeling the endogenous relationship through a first-stage regression. The results from the first-stage regressions are posted in Appendix 5.D. Next to the estimation of both models for the complete sample a sub-sample of OECD countries is considered. This is in line with previous research that only considers the effect of trust for OECD countries (see for instance Knack and Keefer, 1997). Where applicable, variables have been transformed logarithmically (base e). As per Ando and Hodoshima (2007), bootstrapped heteroskedasticity robust standard errors are used for all regressions (500 replications). Estimation results are posted in Table 5.2. The first equation of the system is printed at the top of the column.

Judging by the value for the R^2 of 0.42, the cross-sectional variance in *Interpersonal trust* is explained reasonably well by each model, and is in line with recent studies from Delhey and Newton (2005) and Bjørnskov (2006). Judging by the value for the R^2 of 0.18, the explained cross-sectional variance in the *Efficiency factor* η is relatively large: approximately one fifth of a country's efficiency in converting human skills to technology is accounted for by *Interpersonal trust*. If a sub-sample of OECD countries is considered, this effect increases to almost 50%.

The relationship between the development of technological capabilities and trust can be viewed in two ways. Equation 1 models the outcome of this process: if trust positively affects technological development, then countries with high technological capabilities should have high levels of trust. The results confirm this expected observation. The difference in trust *attributable to the difference in technological capability* between the the least technologically developed country, Burkina Faso, and the highest scoring country, Sweden, is about 70 to 80 (depending on the SUR or 3SLS estimate; holding the other factors constant). Also, judging by the insignificance of most of the control variables the proposed mechanism whereby a demand for technological development introduces a demand for trust seems highly plausible. Removing the *ArCo Tech. Cap. Index* reveals that *Protestants (%)*, *Monarchy*, and *Gini* become significant and have higher coefficient values. This is in line with previous empirical research, such as Bjørnskov (2006). However, including the *ArCo Tech. Cap. Index* shows that only the effect of the variable *Protestants (%)* remains significant in all samples.

Equation 2 models *how* trust affects a country's technological development. Because trust lowers barriers to information sharing, high-trust countries transform their raw human capital (tertiary education, average years of total schooling and the literacy rate) into new technological developments (scientific articles, patents) more efficiently. *Interpersonal trust* positively affects the *Efficiency factor* η : an increase in the trust variable of 10 increases the efficiency of conversion by about 80%. The magnitude of this effect for the OECD sample is about 20% (although trust explains substantially more of the variance in η for this sample).

Overall, the theoretical relationships as depicted in Figure 5.2 and Figure 5.3 are con-

	<i>SUR</i> Full sample	<i>3SLS</i> Full sample	<i>SUR</i> OECD	<i>3SLS</i> OECD
<i>Equation 1</i>				
ArCo Tech. Cap. Index	74.74*** (15.38)	96.20*** (24.96)	139.61*** (36.29)	93.90 (101.82)
Protestants (%)	0.34*** (0.10)	0.20* (0.12)	0.32** (0.13)	0.39* (0.20)
Monarchy (1=yes)	8.76 (5.40)	5.39 (4.66)	13.02* (7.18)	12.42 (8.52)
Rule of Law	0.79 (3.30)	1.39 (3.69)	2.77 (6.72)	6.02 (10.74)
Communism (1=yes)	3.85 (5.45)	3.15 (4.40)	-1.33 (7.34)	-6.51 (13.21)
Ethnic fractionalization	0.87 (9.22)	3.03 (8.25)	8.09 (16.71)	6.68 (21.97)
Language fractionalization	3.93 (8.02)	4.85 (7.73)	-17.74 (20.52)	-12.34 (26.90)
Religion fractionalization	-9.80 (8.26)	-5.68 (7.89)	-8.07 (12.23)	-2.30 (17.55)
Gini	-0.37 (0.23)	-0.27 (0.23)	-0.29 (0.54)	-0.52 (0.77)
Constant	31.45** (12.32)	18.84 (16.58)	-17.97 (29.33)	9.22 (63.44)
<i>Equation 2</i>				
Interpersonal trust	0.05*** (0.01)	0.06*** (0.01)	0.02*** (0.01)	0.02*** (0.01)
Constant	-6.11*** (0.38)	-6.76*** (0.60)	-2.80*** (0.37)	-2.73*** (0.42)
Observations	103	103	34	34
$R^2(1)$	0.46		0.85	
$R^2(2)$	0.18		0.48	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.2: Seemingly unrelated regression (SUR, 3SLS) for dependent variables: *Interpersonal trust* (1), *Efficiency factor η* (2). 3SLS instruments: *Distance to Dudley (Log. km.)* and *Distance to Silicon Valley (Log. km.)* (1), *Freedom press (Log.)* (2). Bootstrapped heteroskedasticity robust standard errors in parentheses (500 replications).

firmed. This is an interesting observation in itself, in that it adds credibility to the use of trust from a 'knowledge-based theory of the firm' perspective. The following section will deal with the question of whether this improves our understanding of the economic effect of trust as well.

What follows is a short treatment of the control variables. The variable *Protestants (%)* (and *Monarchy* for the OECD sample) positively affects the trust score: countries with larger shares of Protestants in the population on average have higher trust levels. *Communism* and *Rule of law* bear the expected sign, but do not exceed the significance threshold. The correlation table (Appendix 5.C) reveals that the *Rule of law* is highly correlated with the *ArCo Index*. The quality of institutions potentially affects a country's technological capabilities, for instance, through the development of a well-functioning and fully accessible electricity grid. Even though the variable *Rule of law* does not aim to measure this particular dimension of institutional quality the difference between this and other variables from the Worldwide Governance Indicators data is generally small. There might thus be a substantial amount of overlap between the *Rule of law* and variables which may be indirectly affected by the quality of institutions, such as the *ArCo Index*. I suspect that a similar collinear effect is picked up for (former) communist countries. The results for the three fractionalization variables are in line with previous findings: more diverse populations have lower levels of trust (with a value of 1 indicating complete fractionalization, and 0 complete homogeneity). However, the effect is not significant. A similar explanation holds for the variable *Gini*. Again, these findings suggest that the proposed technological development mechanism is highly relevant for explaining the existence of, and reason for, the observed cross-country differences in trust.

Alternative model

As was discussed in Section 5.3, the time of measurement of the data on *Interpersonal trust* and the *ArCo Index* is not entirely consistent with the the causal model from Figure 5.3 (on page 115). Therefore, an additional analysis was performed with data from the World Values Survey only, which holds longitudinal data on interpersonal trust for a limited number of countries. The results of this analysis are posted in Appendix 5.E. The conclusion from this model is similar to the one provided here.

5.5.2 Economic interpretation

The previous analysis shows that much of the variance in the *Efficiency factor η* is explained by a country's level of interpersonal trust. In terms of finding the 'correct' mechanism for the economic effect of trust, it would be interesting to see how well this particular variable (η) explains differences in economic outcomes. In particular, if trust has an effect on the *Efficiency factor η* , and if countries that are more efficient (higher *Efficiency factor η*) have higher levels of economic development, then the economic effect of trust is indirect (as opposed to often used direct effect on economic outcomes). Similar to the example from the

Theoretical framework, the per capita gross domestic product, *GDP cap. (Log.)*, is plotted against η in Figure 5.4.

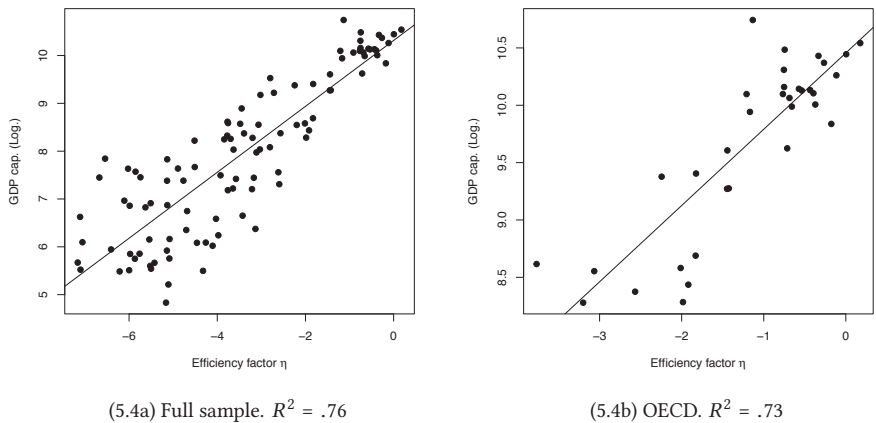


Figure 5.4: Linear relationship between *GDP cap. (Log.)* and the *Efficiency Factor* η for (a) full sample of countries ($N = 103$) (b) OECD ($N = 34$).

Bear in mind that for the left-hand figure, 18% of the variance is explained by a country's interpersonal trust level. For the right-hand figure, this is 48%. The figure shows that the *Efficiency Factor* η is a good predictor of the average income in a country. If one were to run a regression with simply these two variables, R^2 values of 0.76 (using the full sample of countries) and 0.73 (using only OECD member countries) are found. If one multiplies these values with the R^2 from the *Efficiency Factor* η equation from the previous section, then the effect of trust on per capita income (through η) is about 14% (full sample) and 35% (OECD). That is, 14% of the variance in cross-country differences can be related to differences in trust if the full sample is considered. If a sub-sample of OECD countries is considered, then 35% of the differences in income can be related to differences in trust.

Furthermore, to further illustrate the fact that the transaction-cost interpretation of the effect of trust is less accurate than the interpretation of trust as facilitator of knowledge sharing, the results of a simple linear regression are printed in Table 5.3. The relationship is similar to the one from Figure 5.4, however, in line with previous research the interpersonal trust score for each country is added as independent variable. The results show that the effect of trust is completely usurped by the *Efficiency Factor* η .

	<i>Full sample</i>	<i>OECD</i>
Efficiency factor η (Log.)	0.68*** (0.04)	0.59*** (0.10)
Interpersonal trust	0.00 (0.00)	0.00 (0.00)
Constant	10.18*** (0.25)	10.16*** (0.28)
Observations	103	34
R^2	0.76	0.74

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.3: Regression output. Dependent variable: *GDP cap. (Log.)*. Heteroskedasticity robust standard errors in parentheses.

5.5.3 Limitations and remarks

Some limitations concerning the current study should be addressed. First, the relationship between trust and technological capabilities is defined as a path-dependent process. However, the study only deals with a cross-sectional 'snapshot' of this process. This is inherent to data on trust, for which time series are notoriously hard to come by. Related to this problem is the fact that relationship between trust and technological development may be reversed. In the current study, this was addressed by assuming that each country has a positive 'demand' for the development of technological capabilities, which results in a positive demand for interpersonal trust. An instrumental variables model was estimated to further limit this potential for reverse causality. Finally, an additional analysis was performed which incorporated *some* longitudinal data. However, I acknowledge that in practice this problem is hard to solve in the cross-sectional dimension.

Second, the data used were not always from similar periods. For instance, the ArCo index was constructed using data from 1997-2000, whereas the values for interpersonal trust were from surveys conducted between 1997 and 2008. Although most variables were matched to the period for which the ArCo index was constructed, the results contained in this study rely on a very relaxed view of temporal causality (in particular, the estimation of η). However, I hope that the results are sufficient proof of the plausibility of the proposed mechanisms. Furthermore, many alternative indexes exist that aim to measure a country's technological capabilities. The ArCo index was chosen as it suited the cross-sectional analysis for developed and developing countries best. Although I believe that a different operationalization of a country's technological capabilities will generally lead to similar results, this is not explicitly validated.

Third, given that a firm-level theory on trust is applied, are we measuring the same

type of trust when investigating macro-level differences? For instance, is the general trust level in society similar to the trust level that two organizations hold when exchanging managerial best practices? Theoretically, the concept of trust as explained by Fukuyama (1996) follows this very reasoning: *because* trust facilitates 'micro-economic interactions', it also functions for macro-level phenomena such as the development of large organizations and multinational firms. This may have the appearance of introducing an ecological fallacy.²² However, here it should be recognized as a condensed version of the micro-level behavior of individuals, similar to the application of human capital to macro-economic outcomes.

Finally, some of the elements in the total effect of trust may be grouped under the header of transaction-cost economics. However, here I agree with Nahapiet and Ghoshal (1998), who argue that analyzing firms through social relations fundamentally contrasts with the atomistic, neo-classical view of the existence of the firm as transaction cost minimizer. While there may be some overlap, the main motivation of firms is to develop higher levels of absorptive capacity. If firms are what makes up a complete economy, then there is no reason to assume that this motivation would be different on the macro level.

Perhaps the only thing that is different are the policy recommendations that one would derive from this study's results. I acknowledge that the applying the concept of absorptive capacity to the macro-level is a fairly abstract way of looking at reality. However, the results do propose that the mechanism holds: the 'fuel' for converting potential to realized absorptive capacity is trust. Therefore, I would suggest that it is never enough to focus solely on education, or solely on innovation (i.e. patents, scientific articles and so forth). Rather, the space in between these two seems important, as this is where the transmission (translation) of knowledge and innovation to technological progress occurs. It may therefore not come as a surprise that the most popular open source operating system, Linux, was initially developed by Linus Torvalds (Finland, high-trust). By definition, its development is based on knowledge sharing and creation: its source code is freely available for everyone to see, discuss and modify. According to data from Tuomi (2004) and the 'Linux Counter Project' (<http://www.linuxcounter.net>), the Scandinavian countries (which can all be considered high-trust societies) remain the heaviest users of the system in the world, as well as one of the most important contributors to its development (both adjusted for population size). Somehow, sharing knowledge and innovations is highly encouraged in these countries.²³

²²In general, the ecological fallacy means that characteristics of the group as a whole do not necessarily explain the characteristics of an individual element of the group.

²³Perhaps the mutually agreed upon absence of contracts is not only the reason for the development of innovative software projects, but also for trust. While discussing the reasons for adopting a specific open source license which would guide new code modifications, Linus Torvalds replied: *"I think people can generally trust me, but they can trust me exactly because they know they don't have to."* Source: Linux Kernel Mailing List, 22 September 2006, <http://www.lkml.org>

5.6 Conclusion

Why do countries with high levels of interpersonal trust have higher levels of economic development? Previous research has produced mixed results concerning the link between a society's level of interpersonal trust and macro-economic outcomes. This study argues that the dominant theoretical framework used to explain the economic impact of trust, transaction cost economics, is part of the reason of these mixed results. Instead, this study uses insights from the management literature to show that the development of interpersonal trust is positively related to a country's development of technological capabilities.

Recent advances in the management literature attribute differences in competitive advantage of firms to differences in the ability to develop 'absorptive capacity'. This capacity on the one hand relates to the firm's ability to gather, absorb and interpret knowledge (the firm's potential absorptive capacity) and on the other the firm's ability to create new knowledge and transform it into commercial ends (the firm's realized absorptive capacity). Transforming the firm's potential absorptive capacity to realized absorptive capacity is not a matter of lowering transaction costs, but a matter of increasing knowledge-sharing through informal social mechanisms that promote the sharing of ideas, interpretations and trends (through knowledge sharing in informal social networks) and formal social relationships that improve understanding and comprehension (for instance, through R&D alliances, or through spill-overs from knowledge centers such as universities). It is suggested that firms that are more successful at lowering barriers to information sharing are more efficient in exploiting potential absorptive capacity.

This study takes the concept of absorptive capacity and applies it to the macro-environment. Through a literature review it is argued that interpersonal trust may facilitate the sharing of knowledge, and act as a proxy for investigating cross-country differences in economic development (related to the conversion of potential to realized absorptive capacity). High levels of trust allow countries to more efficiently convert human capital (potential absorptive capacity), such as formal education, into technological progress (realized absorptive capacity), such as patents. This idea is tested using two regressions in a seemingly unrelated regression framework. The first regression models a country's trust level as a function of its technological capability, which is the macro-level equivalent of the firm's absorptive capacity. If trust facilitates the exploitation of potential absorptive capacity, then countries with high technological capabilities should have higher levels of trust. The second regression divorces this process into its two components, potential and realized absorptive capacity, to show why this is the case: trust allows countries to more efficiently make this transformation. This system of equations approach recognizes the path-dependent relationship between both constructs: trust affects the development of technological capabilities, while at the same time the positive demand for higher technological capabilities increases the trust level.

The regression results confirm the mechanism behind the economic effect of trust: countries with high levels of technological capability indeed have higher levels of trust. Furthermore, trust indeed increases the efficiency by which countries increase their technological capability. An illustration of each country's per capita income level is provided

to show that contrary to previous studies, the effect of trust is completely usurped by this efficiency parameter. This shows that the economic effect of trust runs through a country's development of technological capabilities (absorptive capacity), and cannot simply be modeled as a direct effect as suggested by previous research using the concept of transaction costs.

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Appendix 5.A Regression output illustration

Table 5.4 shows that although there is a positive relationship between trust and the economic outcome variable, *GDP cap. (Log.)*, the explanatory power of a country’s technological capability, measured here through the *ArCo Technological Capabilities Index* (Archibugi and Coco, 2004) is much higher: the value for the R^2 is over four times larger.

	(1)	(2)
Interpersonal trust	0.03*** (0.00)	
ArCo Tech. Cap. Index		7.61*** (0.31)
Constant	6.62*** (0.27)	4.95*** (0.13)
Observations	103	103
R^2	0.20	0.81

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.4: Regression output for graphic illustration. Dependent variable: *GDP cap. (Log.)*. Heteroskedasticity robust standard errors in parentheses.

Appendix 5.B Interpersonal trust

The following table shows an overview of the various surveys that were used (including the year of the survey) by ASEP/JDS (<http://www.jdsurvey.net>) to calculate the interpersonal trust score. Individual surveys can be located at the following address:

- European Values Study: <http://www.europeanvaluesstudy.eu/>
- World Values Survey: <http://www.worldvaluessurvey.org/>
- Global barometer: <http://www.jdsurvey.net/gbs/>
- Latinobarometro: <http://www.latinobarometro.org/>
- East-Asia barometer: <http://www.asianbarometer.org/>

Country	Code	Int. Trust	Year	Survey
Albania	ALB	51.2	2002	European Values Study
Algeria	DZA	45.3	2005	Global barometer
Argentina	ARG	40.6	2008	Latinobarometro
Armenia	ARM	51.8	1997	European Values Study
Australia	AUS	92.4	2005	World Values Survey
Austria	AUT	70.2	1999	European Values Study
Azerbaijan	AZE	44.2	1997	European Values Study
Bangladesh	BGD	47.7	2002	European Values Study
Belarus	BLR	85.2	2000	European Values Study
Belgium	BEL	63.0	1999	European Values Study
Bolivia	BOL	48.8	2008	Latinobarometro
Botswana	BWA	12.3	2005	Global barometer
Brazil	BRA	17.5	2008	Latinobarometro
Bulgaria	BGR	50.9	2006	World Values Survey
Burkina Faso	BFA	33.6	2007	World Values Survey
Cambodia	KHM	15.6	2008	East-Asia barometer
Canada	CAN	85.9	2006	World Values Survey
Colombia	COL	30.9	2008	Latinobarometro
Costa Rica	CRI	48.9	2008	Latinobarometro
Croatia	HRV	38.7	1999	European Values Study
Cyprus	CYP	21.2	2006	World Values Survey
Czech Republic	CZE	48.8	1999	European Values Study
Chile	CHL	34.4	2008	Latinobarometro
China	CHN	120.9	2008	East-Asia barometer
Denmark	DNK	131.9	1999	European Values Study
Dominican Republic	DOM	74.7	2008	Latinobarometro
Ecuador	ECU	72.7	2008	Latinobarometro
Egypt	EGY	37.2	2008	World Values Survey
Estonia	EST	48.4	1999	European Values Study
Ethiopia	ETH	55.2	2007	World Values Survey
Finland	FIN	117.5	2005	World Values Survey
France	FRA	37.9	2006	World Values Survey
Georgia	GEO	38.2	2008	World Values Survey

Continued on next page

Country	Code	Int. Trust	Year	Survey
Germany	DEU	75.8	2006	World Values Survey
Ghana	GHA	17.4	2007	World Values Survey
Great Britain	GBR	61.7	2006	World Values Survey
Greece	GRC	54.6	1999	European Values Study
Guatemala	GTM	51.9	2008	Latinobarometro
Honduras	HND	47.0	2008	Latinobarometro
Hungary	HUN	44.8	1999	European Values Study
Iceland	ISL	83.0	1999	European Values Study
India	IND	52.5	2006	World Values Survey
Indonesia	IDN	16.9	2006	East-Asia barometer
Iran	IRN	21.8	2005	World Values Survey
Ireland	IRL	72.1	1999	European Values Study
Israel	ISR	48.3	2001	European Values Study
Italy	ITA	60.8	2005	World Values Survey
Japan	JPN	79.6	2005	World Values Survey
Jordan	JOR	62.0	2007	World Values Survey
Kenya	KEN	20.0	2005	Global barometer
South Korea	KOR	56.9	2005	World Values Survey
Kyrgyzstan	KGZ	33.7	2003	European Values Study
Latvia	LVA	35.9	1999	European Values Study
Lebanon	LBN	33.8	2005	Global barometer
Lesotho	LSO	32.7	2005	Global barometer
Lithuania	LTU	52.8	1999	European Values Study
Luxembourg	LUX	53.9	1999	European Values Study
Macedonia	MKD	29.5	2001	European Values Study
Madagascar	MDG	65.6	2005	Global barometer
Malawi	MWI	14.9	2005	Global barometer
Malaysia	MYS	17.7	2006	World Values Survey
Mali	MLI	44.8	2007	World Values Survey
Malta	MLT	42.2	1999	European Values Study
Mexico	MEX	41.7	2008	Latinobarometro
Moldova	MDA	36.7	2006	World Values Survey
Mongolia	MNG	21.4	2006	East-Asia barometer
Morocco	MAR	27.4	2007	World Values Survey
Mozambique	MOZ	56.0	2005	Global barometer
Namibia	NAM	57.8	2006	Global barometer
Netherlands	NLD	90.6	2006	World Values Survey
New Zealand	NZL	102.2	2004	World Values Survey
Nicaragua	NIC	46.1	2008	Latinobarometro
Nigeria	NGA	29.8	2005	Global barometer
Norway	NOR	148.0	2007	World Values Survey
Pakistan	PAK	65.0	2001	European Values Study
Panama	PAN	45.9	2008	Latinobarometro
Paraguay	PRY	22.7	2008	Latinobarometro
Peru	PER	30.5	2008	Latinobarometro
Philippines	PHL	20.1	2005	East-Asia barometer
Poland	POL	40.9	2005	World Values Survey
Portugal	PRT	21.9	1999	European Values Study
Romania	ROU	43.6	2005	World Values Survey
Russia	RUS	55.4	2006	World Values Survey
Rwanda	RWA	10.2	2007	World Values Survey
Senegal	SEN	54.2	2005	Global barometer

Continued on next page

Country	Code	Int. Trust	Year	Survey
Singapore	SGP	59.8	2006	East-Asia barometer
Slovakia	SVK	33.4	1999	European Values Study
Slovenia	SVN	38.6	2005	World Values Survey
South Africa	ZAF	38.0	2007	World Values Survey
Spain	ESP	40.9	2007	World Values Survey
Sweden	SWE	134.5	2006	World Values Survey
Switzerland	CHE	107.4	2007	World Values Survey
Tanzania	TZA	27.6	2005	Global barometer
Thailand	THA	83.1	2007	World Values Survey
Trinidad & Tobago	TTO	7.9	2006	World Values Survey
Turkey	TUR	10.2	2007	World Values Survey
Uganda	UGA	33.8	2005	Global barometer
Ukraine	UKR	60.0	2006	World Values Survey
United States of America	USA	78.8	2006	World Values Survey
Uruguay	URY	54.2	2008	Latinobarometro
Venezuela	VEN	48.5	2008	Latinobarometro
Vietnam	VNM	104.1	2006	World Values Survey
Zambia	ZMB	28.1	2007	World Values Survey

Table 5.5: Interpersonal trust statistics, source surveys.

Appendix 5.C Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.Interpersonal trust	1.00										
2.Efficiency index η (Log.)	0.48	1.00									
3.ArCo Tech. Cap. Index	0.59	0.89	1.00								
4.Protestants (%)	0.54	0.39	0.45	1.00							
5.Monarchy (1=yes)	0.37	0.32	0.35	0.24	1.00						
6.Rule of Law	0.50	0.85	0.81	0.48	0.45	1.00					
7.Communism (1=yes)	-0.01	-0.05	-0.07	-0.16	-0.22	-0.25	1.00				
8.Ethnic fractionalization	-0.27	-0.40	-0.47	-0.09	-0.17	-0.40	-0.08	1.00			
9.Language fractionalization	-0.13	-0.19	-0.28	-0.00	-0.07	-0.21	0.07	0.58	1.00		
10.Religion fractionalization	-0.06	0.14	0.06	0.19	-0.04	0.01	0.15	0.19	0.27	1.00	
11.Gini	-0.43	-0.62	-0.59	-0.19	-0.21	-0.53	-0.30	0.39	0.21	0.08	1.00

Table 5.6: Correlation matrix

Appendix 5.D First-stage regressions

5.D.1 Regression: Interpersonal trust

First-stage OLS regressions are posted in the following table. Judging by the value for both F-statistics (>10) a weak instrument bias is not to be expected (Stock and Yogo, 2005).

As expected, countries with higher scores on the variable *Freedom Press (Log.)*, which are countries with media outlets that are in some way influenced, have lower levels of interpersonal trust. The effect is quite sizable: the variance explained runs from 27% (full sample) to 62% (OECD).

	Full	OECD
Freedom Press (Log.)	-22.98*** (4.98)	-46.81*** (6.11)
Constant	131.10*** (17.65)	201.64*** (19.27)
Observations	103	34
R^2	0.27	0.62
F (2,100)	21.30	
F (2,31)		58.61

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.7: First-stage regression output for dependent variable: *Interpersonal trust*. Heteroskedasticity robust standard errors in parantheses.

5.D.2 Regression: Efficiency factor η

First-stage OLS regressions are posted in the following table. Judging by the value for both F-statistics (>10) a weak instrument bias is not to be expected (Stock and Yogo, 2005), except for the OECD model. Presumably, technological spill-overs through trade have occurred much more frequently between developed countries, rendering the instrument less valid. Although the negative sign is retained, it does not explain any of the variance in the *ArCo. Tech. Cap. Index*. Therefore, the 2SLS coefficients for the OECD sample should be read with caution.

The results for the full sample show the expected relationship: countries that are further removed from both frontiers have lower values of technological development.

	Full	OECD
Distance to Dudley (Log. km.)	-0.09*** (0.02)	-0.01 (0.02)
Distance to Silicon Valley (Log. km.)	-0.17*** (0.05)	-0.03 (0.11)
Constant	2.72*** (0.44)	0.94 (1.03)
Observations	103	34
R^2	0.34	0.01
F (2,100)	24.92	
F (2,31)		0.17

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.8: First-stage regression output for dependent variable: *ArCo. Tech. Cap. Index*. Heteroskedasticity robust standard errors in parentheses.

Appendix 5.E Alternative model

The following estimation uses the same setup as the analysis in the main text. However, to be more 'true' to the temporal nature of the relationships depicted in Figure 5.3 (on page 115) the data of the model is altered as follows:

$$\begin{cases} Trust_{i,T=2} &= \beta_0 + \beta_1 Tech. Cap. _i + \beta_2 Trust\ controls_i + \varepsilon_i \\ \eta_i &= \beta_0 + \beta_3 Trust_{i,T=1} + \varepsilon_i \end{cases},$$

with $Trust_{i,T=2}$ the value of trust for the period 2001-2008, and $Trust_{i,T=1}$ for the period 1991-2000. These values are derived from the World Values Survey only, which holds longitudinal data on a limited number of countries. Additionally, the trust variable is measured as the percentage of people answering "yes" the survey statement "Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?".

If the seemingly unrelated regression approach from Section 5.5 is run, the following results are obtained (Table 5.9). Given the substantially lower number of observations ($N = 39$) the OECD sub-sample is not printed (this sub-sample drops to $N = 18$). The conclusions from this analysis do not differ from the ones presented in the main text. The only difference is that the *ArCo Tech. Cap. Index* is not significant in this model. However, this is most likely the cause of the lower number of observations.

	<i>SUR</i>	<i>3SLS</i>
<i>Equation 1</i>		
ArCo Tech. Cap. Index	0.11 (0.22)	0.11 (0.43)
Protestants (%)	0.00*** (0.00)	0.00* (0.00)
Monarchy (1=yes)	0.09 (0.05)	0.08 (0.06)
Rule of Law	-0.02 (0.03)	-0.01 (0.05)
Communism (1=yes)	-0.03 (0.06)	-0.03 (0.06)
Ethnic fractionalization	-0.07 (0.09)	-0.06 (0.10)
Language fractionalization	-0.00 (0.09)	-0.01 (0.09)
Religion fractionalization	0.07 (0.09)	0.08 (0.11)
Gini	-0.01** (0.00)	-0.01** (0.00)
Constant	0.40*** (0.12)	0.39** (0.15)
<i>Equation 2</i>		
Interpersonal trust 1991-2000	6.57*** (2.28)	9.31*** (2.55)
Constant	-4.73*** (0.62)	-5.53*** (0.67)
Observations	39	39
R^2 (1)	0.77	0.77
R^2 (2)	0.23	0.15

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.9: Seemingly unrelated regression (SUR, 3SLS) for dependent variables: *Interpersonal trust* 2001 – 2008 (1), *Efficiency factor* η (2). 3SLS instruments: *Distance to Dudley (Log.km.)* and *Distance to Silicon Valley (Log.km.)* (1), *Freedom press (Log.)* (2). Bootstrapped heteroskedasticity robust standard errors in parentheses (500 replications).

6

Conclusions

In this final chapter, I would like to return to the discussion from the Introduction. There, I asked the question of whether trust matters for economic outcomes beyond my anecdotal evidence. Given the result from the four previous studies, it appears that it does. From micro-economic outcomes in Chapter 2 to very abstract macro-economic outcomes in Chapter 5: trust matters. Furthermore, while the result seems to be modest in the micro-economic setting (with trust explaining only a couple of percentage points in wage and income), it appears that small effects add up: for a sub-sample of OECD countries, the trust level explains over 50% of a country's ability to put knowledge to productive (technological) use. At this point, we are no longer talking about mere percentage points of impact.

These findings do not necessarily contradict traditional views on economic interaction. Rather, they extend our understanding of 'economic man' by including elements that may appear irrational at first. This holds in particular for the inclusion of interpersonal trust, which (to me) is a text book example of how a single result on economic behavior from the lab can be successfully translated into a concept that explains a much wider set of economic phenomena. Of course, extrapolation sometimes means translation: the reasons why people trust in the lab may be different from the reasons why trust is important for the productivity of countries, or the location decision of multinational firms. This is where the truly exciting part of the equations is, for me: finding out *why* trust matters. Sometimes, this means we can be very precise, such as with the liability of foreignness concept from Chapter 3 or the absorptive capacity from Chapter 5. Other times, we have to be more modest, such as with the catch-all operationalization of trust in the study on productivity (Chapter 4). However, what the latter study (and all others, for this matter) do show is that trust has its place next to the traditional explanations from the field, such as the K and L from the

Solow productivity framework, or the years of schooling from the Mincerian wage equation in Chapter 2.

The results from the final study, Chapter 5, are the most compelling to me in terms of recommending future research directions. Much of the previous research has focused on 'outside' elements that influence trust, such as having a king or queen at the head of the state, or being raised as a Protestant. These can hardly be offered as policy recommendations for governments seeking to bolster civil society. Rather, I think we should look at (endogenous) mechanisms that help to build, sustain and break trust. In this respect, education has long been offered as an explanation for the development of trust (Knack, 2001; Knack and Zak, 2003; Bjørnskov, 2006). However, just as the success of firms must be understood by looking at '*why and how* firms do what they do' (instead of what they do), so must the difference in the cross-country levels of the 'success of education' be understood. *How and why* we learn what we learn is potentially as important as what we learn. Clearly, countries with high levels of trust (such as Switzerland or the Scandinavian countries) are amongst the most developed and prosperous nations. Yet, countries with relatively similar levels of education can differ substantially in terms of economic development. For instance, in both Sweden and France the 'average' individual has spent around 11 years of his life in school.¹ Furthermore, according to the latest 'student performance' report from the "Programme for International Student Assessment" (PISA) (2009), Sweden ranks 17th in the world. France closely follows at position 20. However, the GDP per capita for Sweden is currently \$60,430, while in France it is \$42,503.² The results from the final study of this thesis suggest that a large part of this difference is related to the difference in the trust level between the two countries. Investigating why students somehow 'learn to trust' in one country but not in another will, in my opinion, greatly improve our (practical) understanding of the development of trust and its economic impact.

¹Source: Barro and Lee (2013). Year: 2010.

²Source: World Bank. Year: 2013.

Summary

This thesis investigates the economic impact of interpersonal trust. Trust is measured through a survey question that is frequently asked to thousands of individuals globally: *"Generally speaking, would you say that most people can be trusted, or that you cannot be too careful when dealing with strangers?"* The aim of this question is to obtain a measure for how trusting individuals are towards people they do not know, but with whom they nonetheless interact. The primary goal of this thesis is to show that this measure has economic consequences. The second goal is to explain *how* trust facilitates this economic significance.

Chapter 2 advances the hypothesis that individuals who are better able to discern helpful individuals from self-interested individuals are more trusting, and have a lower probability of being exploited. The latter should result in an increase in the individual's economic performance. Using a panel from the German Socio-Economic Panel (2003, 2008) the study finds that being a 'high trust' individual positively influences annual individual labor earnings and hourly wages. Furthermore, 'low-trust' individuals from 2003 that become 'high-trust' individuals in 2008 show a trust-related income increase of 6 to 9% as compared to individuals that remained in the low-trust category.

Chapter 3 (joint work with Dr. Martijn Burger) focuses on differences in foreign direct investments (FDI) between regions in Europe. When investing in a foreign country multinational enterprises face social, political and organizational information asymmetries. These liabilities of foreignness (LOF) introduce additional costs, threaten profitability and deter foreign direct investments. The study investigates if certain regions are better able to mitigate these liabilities, and therefore attract more FDI. The level of regional trust, defined as the society average for interpersonal trust per region, is used as potential mediator of the liability of foreignness. Using European cross-sectional data from 2003-2011 on the number of cross-border greenfield investments and the regional trust level, we confirm that the level of regional trust positively affects the number of investments that a region receives. The effect of regional trust is sizable (factor 1.65 and above per one unit increase in regional trust). Firms with a higher probability of facing a LOF (operationalized by geographic, institutional and genetic distance between the home and host country) more often locate in regions with a higher trust level.

Chapter 4 uses the Solow productivity framework to study the effect of trust. Three productivity-related effects are recognized. The effect of trust on (i) labor (where trust reduces principal-agent problems related to asymmetric information), (ii) capital (where

trust facilitates access to the embedded resources in networks of agents,) and (iii) the quality of institutions (which is affected by trust through the absence of bureaucratic rules, corruption or excessive rent-seeking). To empirically test the sign and significance of the economic effect of trust, the study relates the share of high-trust individuals per country to the between-country level and within-country growth of total factor productivity from the Solow model. Cross-sectionally, high-trust countries on average have higher levels of productivity. Longitudinally, the results show that an increase in trust is positively related to the growth of productivity in the last two decades (where $t_1 = 1990 - 1999$, and $t_2 = 2000 - 2008$). However, this relationship only significantly explains productivity growth for developed countries (OECD). This finding suggests that the economic effect of trust may be dependent on within-country development characteristics.

Chapter 5 aims to find these within-country characteristics. The concept of absorptive capacity is used to show that the relationship between a country's technological capabilities and trust level is path dependent. Trust allows countries to more efficiently convert human capital (such as formal education) into technological progress (such as patents and scientific insight). At the same time, the positive demand for higher technological capabilities increases the trust level (which further allows for technological development). A cross-country regression analysis is used to confirm these relationships. The income per capita is used as an example to show that, contrary to findings from previous research, the macro-economic effect of trust runs completely through the development of technological capabilities.

Samenvatting

Dit proefschrift onderzoekt de economische impact van algemeen vertrouwen. Dit vertrouwen wordt gemeten aan de hand van de volgende surveyvraag, welke regelmatig aan duizenden mensen wereldwijd wordt gesteld: *"Denkt u, in het algemeen, dat de meeste mensen te vertrouwen zijn, of dat je niet voorzichtig genoeg kunt zijn in de omgang met mensen?"* Het antwoord op deze vraag geeft aan hoeveel vertrouwen individuen hebben in 'de anonieme medemens'. Het primaire doel van dit proefschrift is om te laten zien dat dit vertrouwen economische consequenties heeft. Het secundaire doel is om te verklaren *hoe* dit 'vertrouwenseffect' functioneert.

Hoofdstuk 2 stelt dat individuen die beter zijn in het uit elkaar houden van behulpzame en niet behulpzame individuen een hoger algemeen vertrouwen hebben. Tevens zullen zij een lagere kans hebben om economisch 'misbruikt' te worden. Dit laatste is, in theorie, inzichtelijk te maken door naar verschillen in de economische prestaties van individuen te kijken. Ik onderzoek deze stelling door verschillen in inkomen en loon te vergelijken met verschillen in vertrouwen voor een panel van Duitse individuen (German Socio-Economic Panel voor de jaren 2003 en 2008). De studie laat zien dat mensen met een 'hoog' vertrouwen significant meer per jaar en per uur verdienen dan mensen met een 'laag' vertrouwen. Daarnaast is er een significant en positief verschil van 6 tot 9% tussen het inkomen van dezelfde individuen die van 'laag' (2003) naar 'hoog' (2008) vertrouwen veranderen over de tijd.

Hoofdstuk 3 (in samenwerking met Dr. Martijn Burger) focust op de verschillen in directe buitenlandse investeringen (DBI) tussen regio's in Europa. Wanneer multinationals investeren in het buitenland dienen zij rekening te houden met kosten die voortvloeien uit het feit dat er sociale, politieke en organisatorische verschillen zijn tussen het land van herkomst en het investeringsland. Dit 'buitenlands nadeel' brengt kosten met zich mee, en vormt zodoende een bedreiging voor de winstgevendheid van een multinational. In deze studie stel ik dat multinationals dit nadeel meewegen in hun locatiekeuze. Om dit te onderzoeken kijk ik of sommige regio's beter zijn in het minimaliseren of 'vermijden' van dit nadeel, en daardoor meer DBI aantrekken. Ik gebruik het algemeen vertrouwen per regio als een indicator hiervoor. Een analyse van het aantal DBI tussen 2003 en 2011 laat zien dat regio's waar individuen een hoger algemeen vertrouwen hebben significant meer multinationals aantrekken (een verschil per vertrouwensniveau van een factor 1.65 en hoger). Bedrijven met een hogere risico op een 'buitenlands nadeel' (geoperationaliseerd door middel van het nemen van de geografische, institutionele en genetische afstand tussen

het land van herkomst en het investeringsland) kiezen inderdaad vaker voor een locatie met een hoog algemeen vertrouwen dan bedrijven waarvoor dit nadeel niet geldt.

Hoofdstuk 4 bestudeert vertrouwen vanuit het Solow productiviteitsmodel. Drie productiviteitseffecten van vertrouwen worden onderscheiden: het effect op (i) arbeid (waarbij vertrouwen principaal-agent problemen verhelpt), (ii) kapitaal (waarbij vertrouwen toegang verschaft tot productiemiddelen die zijn ingebed in netwerken), en (iii) institutionele kwaliteit (waarbij vertrouwen zorgt voor minder bureaucratie, corruptie en 'politieke rente'). De studie relateert het percentage 'hoog vertrouwen' individuen per land aan de verschillen in productiviteit tussen landen, alsmede de groei van de productiviteit binnen een land. Gemiddeld genomen hebben landen met een 'hoog vertrouwen' een hoger productiviteitsniveau. Eenzelfde positieve effect wordt gevonden voor de productiviteitsgroei in de laatste twintig jaar: een groei van het algemene vertrouwen gaat samen met de groei van de productiviteit binnen een land (waarbij $t_1 = 1990 - 1999$, en $t_2 = 2000 - 2008$). Echter, dit verband is alleen significant wanneer OECD landen worden gebruikt in de analyse. Dit suggereert dat de economische impact van vertrouwen afhankelijk is van specifieke kenmerken die enkel aanwezig zijn in relatief ontwikkelde landen.

Hoofdstuk 5 onderzoekt één van deze kenmerken. Ik gebruik de 'absorptiecapaciteit' theorie om te laten zien dat de technologische ontwikkeling van een land, alsmede de ontwikkeling van algemeen vertrouwen, pad afhankelijk is. Vertrouwen zorgt ervoor dat landen 'human capital' (zoals formele scholing) efficiënter omzetten in nieuwe technologische ontwikkelingen (zoals patenten en wetenschappelijke inzichten). Tegelijkertijd zorgt deze verhoogde technologische ontwikkeling ervoor dat er een hogere 'vraag' naar vertrouwen ontstaat (welke de volgende stap in de technologische ontwikkeling mogelijk maakt). Een cross-sectionele regressieanalyse bevestigt beide verbanden. Daarnaast gebruik ik het gemiddelde inkomen per hoofd van de bevolking om te laten zien dat, in tegenstelling tot andere studies, het macro-economische effect van vertrouwen geheel door de technologische ontwikkeling van een land loopt.

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Currently, in economics trust is often disregarded. It is difficult to reconcile trusting behavior with the classical view of 'economic man' as a completely rational, self-interested being. This thesis includes four studies where this behavioral assumption does not hold, however. In fact, they show that more trust is better in various dimensions. From individual income and the location decision of multinational firms to the productivity and technological development of countries: trust matters. Each study identifies how trust generates economic value, and how large the effect of trust is. Furthermore, the development of trust is modeled to explain why there exist such large differences in trust levels between individuals, regions and countries.

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